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HEALTH CENTER

Graduate Management Project:

To Validate Resource Utilization of a New Military Family Health Center

at the National Naval Medical Center

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13. ABSTRACT *(Maximum 200 words)*

THIS GRADUATE MANAGEMENT PROJECT VALIDATES RESOURCE UTILIZATION OF THE NEW MILITARY FAMILY HEALTH CENTER (MFHC) AT THE NATIONAL NAVAL MEDICAL CENTER IN BETHESDA, MARYLAND, USING THE HEALTHCARE SIMULATION SOFTWARE MEDMODEL®. OVERALL, UTILIZATION OF RESOURCES IN THE MFHC RANGED FROM LESS THAN A PERCENT TO 80 PERCENT. THE UTILIZATION OF THE PRIMARY CARE PROVIDERS IN THE MFHC RANGED FROM SIX PERCENT TO 80 PERCENT AND THE UTILIZATION OF THE REMAINING SUPPORT STAFF IN THE MFHC RANGED FROM LESS THAN A PERCENT TO 65 PERCENT. IN CONSULTATION WITH THE STAFF OF MEDMODEL®, UTILIZATION RATES OF AT LEAST 65 TO 75 PERCENT ARE OPTIMUM.

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Abstract

This graduate management project validates resource utilization of the new

Military Family Health Center (MFHC) at the National Naval Medical Center in

Bethesda, Maryland, using the healthcare simulation software MedModel®. Overall,

utilization of resources in the MFHC ranged from less than a percent to 80 percent.

The utilization of the primary care providers ranged from six percent to 80 percent

and the utilization of the remaining support staff in the MFHC ranged from less than

a percent to 65 percent. In consultation with the staff of MedModel®, utilization

rates of at least 65 to 75 percent are optimum.

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Introduction

Graduate Management Project:

To Validate Resource Utilization of a New Military Family Health Center

at the National Naval Medical Center

Located in Bethesda, Maryland, the National Naval Medical Center (NNMC) is by size, among the ten largest medical facilities in the United States. The Center employs more than 4,200 people (military and civilian), has an operating capacity of over 200 beds (expandable to about 300 in an emergency), and has over 50 clinics in outpatient services that treat approximately 2,500 patients daily. The mission of NNMC is to maintain medical readiness and quality health services for the uniformed services, and provide comprehensive training, education, research, and managed care (National Naval Medical Center [NNMC], 1997).

At NNMC, a group of primary care and specialty providers, nurses, and administrators met since May 1996, to develop a concept of operation of a military family health center (MFHC [Primary Care Committee, 1996]). The objectives of the MFHC are to:

- Provide primary care services (same day care, health promotion, occupational and military medicine, and some specialty care at one site)
- Improve access to needed medical care while reducing cost
- Enroll beneficiaries into their plan

The target populations of the MFHC are the NNMC military staff and their family members and the beneficiaries within the geographic catchment area of NNMC (Moeller & Thomas, 1997).

Current staffing plans were based on population projections and outpatient utilization. The population projections were based on 100 percent of the active duty assigned to the National Naval Medical Center and commands within the catchment area, 72 percent of other TRICARE eligible beneficiaries (family members and retirees less than 65 years old) living in the catchment area, and 15 percent of Medicare eligible beneficiaries who would elect enrollment at the MFHC. These projections were obtained from the applicable Unit Identification Code alpha rosters and Fiscal Year 1994 Resource Analysis and Planning System, Version 8.1 data (Primary Care Committee, 1996). Outpatient utilization rates were based on the 1995 RAND Corporation published report on military beneficiary data and calculated average visit per person (Moeller et al., 1997).

Current staffing plans consist of (ten full-time equivalent providers):

- two family physicians

- two internists

- one pediatrician

- two general medical officers (general practitioners)

- one occupational medicine physician

- one physician assistant

- three nurse practitioners (including one part-time gynecology nurse practitioner)

- one health promotion nurse

- one independent duty corpsman

- part-time providers from multiple sources (i.e., Uniformed Services' University of Health Sciences, U.S. Public Health Service, etc.)

- five triage nurses

- one occupational health nurse

- two occupational health technicians

- 49 hospital corpsmen

<u>Conditions which prompted the study</u>

In November of 1995, the Department of Defense (DoD) embarked on a new program, called TRICARE. Under this program, all health care beneficiaries became participants in TRICARE and were classified into one of four categories:

- Active duty members, all of whom were automatically enrolled in TRICARE Prime, a health maintenance organization (HMO)-type option;

- TRICARE Prime enrollees, who (except for active duty members) must be Civilian Health and Medical Program of the Uniformed Services (CHAMPUS) eligible;

- TRICARE Standard participants, which includes all CHAMPUS-eligible beneficiaries who did not enroll in TRICARE Prime; or

- Medicare-eligible beneficiaries and other non-CHAMPUS-eligible DoD beneficiaries, who, although not eligible for TRICARE Prime, may participate in many features of TRICARE (Joseph, 1995).

CHAMPUS eligible beneficiaries are offered three options:

(1) They may enroll to receive health care in an HMO-type program called "TRICARE Prime;" or

(2) use the civilian preferred provider network on a case-by-case basis, under "TRICARE Extra;" or

(3) choose to receive care from non-network providers and have the services

reimbursed under "TRICARE Standard (same as standard CHAMPUS

[Joseph, 1995])."

Healthcare services are currently undergoing many fundamental changes.

Growing demand within a context of economic constraint are creating a need for

efficiency savings and tighter control of limited resources. Healthcare executives are

invariably faced with processes which are highly complex and interactive in nature.

Computer simulation offers a tool which will enable them to accurately assess and

quantify the impact of changes as well as an opportunity to critically evaluate

alternatives. This project will validate and offer an objective evaluation of the

existing staffing plans and potentially, optimize staffing options.

Statement of the Problem

In support of TRICARE, DoD has already shifted Military Treatment Facilities

away from the traditional workload incentives to justify resources to that of

capitation budgeting (U.S. General Accounting Office, 1995). NNMC must validate

the proposed staffing plans for the new MFHC.

Literature Review

Providing healthcare services for the entire family and making them

accessible are important components in the delivery of care, as is a focus on disease

prevention or maintenance, wellness programs, and health education. Past research

of family care contends that primary care improves when intervention extends

beyond the individual to include the family (Bauman & Grace, 1974; Curry, 1974;

Geyman, 1977; Marinker, 1976; Merkel, 1983; Williamson, McCormick, & Taylor,

1983; and Bayard, W. & Allmond, J. R., 1987). The family has been shown to influence both health status and health care utilization (Campbell, 1986; Newacheck & Halfon, 1986; and Schor, Starfield, Stidley, & Hankin, 1987).

Doescher and Franks found that family care occurs in about 35 percent of U.S. families. Their Household Survey which was a component of the 1987 National Medical Expenditure Survey also found that family care was more prevalent in families that resided in rural areas and outside the Northeast (1997). Murata and Kane found from those enrolled in the RAND Health Insurance Experiment, that children received less family care, but as families matured, family care increased for both children and parents (1987). Two previous studies of family-centered care have shown only a small percentage of families receive their care from a single physician (McKenna & Wacker, 1976; and Fujikawa, Bass, & Schneiderman, 1979). Additionally, Murata and Kane found from those enrolled in the Rand Health Insurance Experiment and designating a single primary care physician, that family physicians and general practitioners provided 65.9 to 89.7 percent of their family care. Internists provided 20.0 and 27.3 percent of family care for younger and older couples, respectively. The remaining specialties, including pediatrics and obstetrics-gynecology, each provided less than 5 percent of family care (1989).

Operations research and management techniques have been applied to healthcare operations to gain insight into the consequences of restructuring an operating system without altering it. The objectives have been to demonstrate a reduction in costs associated with more efficient resource utilization, to improve the

quality of service, or to foresee any adverse consequences of a proposed system alteration. No one is certain when the first model was developed, but the principle of using symbolic representations to better understand the interactions of various parts of a system is probably as old as scientific method (Harrell, Bateman, Gogg, & Mott, 1996). Previous studies of the health care delivery process have used motion, time , and method studies (Reiber, 1965; Goss, Reed, & Reader, 1971; Heagarty, Boehringer, Lavigne, et al, 1973; Mamlin & Baker, 1973; Dubin, Ambleu, & Revers, 1974; Fineberg & Stewart, 1977; Fries, Gutkin, & Ginsberg, 1977; Wirth, Kahn, & Perkoff, 1977; Cue & Inglis, 1978; Heckerling, 1984; and Saunders, 1987;), queuing models (Ishwar, Zorenda, & Kramer, 1971; Rising, Baron, & Averil, 1972; and Nelson, 1982), and relatively simple computer simulation models (Weissberg, 1977). A simulation model is a detailed scale model of a system which closely imitates events and actions which occur within a system. The simulation performs these episodes in a very compressed time, which allows a model to emulate the long-term behavior of a system in a short time (Levy, Watford, & Owen, 1989). Previous health care simulation models have been limited by their simplicity or by their requirement for expensive, sophisticated mainframe computers (Nelson, 1982; and Weissberg, 1977). However, these studies were breakthroughs in their time and warrant consideration even today. In the 1960s, Balintfy attempted to develop a random model for the arrival process of hospital inpatients. He based the model on an examination of the effects of disease proneness, contagion, and time on the risk function of the population (Swartzman, 1970). Welch and Bailey pioneered the use of queuing theory in the health field in evaluating appointment systems for an

outpatient department, and the study of scheduling systems remained its main application in the health field until Hausmann took a different perspective in using it to establish an index of quality of care based on waiting times for service (Ishwar et al., 1981). In 1977, Clayden developed a model which predicts the incidence of morbidity and mortality in a specified population and the changes in resource use over a period of years. Thus it is possible to see the long term effects of changes in population size and structure alongside the effects of management decisions on the use of health resources (1977). Wright created a model in 1987 to determine simulated patient arrivals to assess utilization in specific inpatient and outpatient departments within a hospital, which was a follow-up to Fetter and Thompson's 1965 study (Butler, Reeves, Karwan, & Sweigart, 1992).

Today, simulation models are powerful, Saunders, Makens, and Leblanc proved that a very sophisticated simulation model can be run for a complex emergency department, even using inexpensive computer hardware and software (1989). A growing number of hospitals are using health care-specific simulation technology to help identify process improvements, particularly when there are a number of alternatives under consideration. Hashimoto, Bell, and Marshment devised a computer program to simulate their 12-bed medical/cardiac intensive care unit workload and staffing (1987). Using the model, they were able to determine the best staffing level per shift. Hashimoto and Bell used computer simulation to study patient flow in an appointment-based, outpatient internal medicine clinic involving multiple, sequential providers (registrar, triage nurse, physician, and discharger [1996]). Subsequent operational changes significantly decreased the average

observed patient total time in clinic from 75.4 minutes to 57.1 minutes. SunHealth alliance hospital used simulation technology to test alternatives and chose a solution that significantly reduced the length of stay for patients in their emergency department (McGuire, 1997).

Mahachek of The Johns Hopkins Hospital states, "simulation of patient flow is a remarkably useful tool. With today's software for personal computers, simulation is no longer just for academics and consultants. Senior and mid-level managers should actively seek out simulation as a problem-solving technique" (1992).

<u>Purpose</u>

The purpose of this project was to validate, through computer simulation, the proposed staffing plans for the new MFHC at NNMC. Healthcare simulation is used to focus on issues such as resource utilization and system capacity and capability. A valid and reliable system model will make it possible to test new ideas for system design or improvement before committing the time and resources necessary to build or alter the actual system. Results that would of previously taken time for the system to operate extensively, can be obtained in a relatively short time frame. The results of this project will be available to the management of the MFHC as a tool and will remain useful as long as maintained.

<div align="center">Methods and Procedures</div>

A decision to do a simulation project usually results from a perception that simulation can help resolve one or more issues associated with the design of a new system or the modification of an existing system. Once a suitable project has been

identified as a candidate for simulation, decisions must be made about how to conduct the project. There are no strict rules on how to perform a simulation project, however, Law and Kelton recommend the following steps (1991):

- Plan the study

- Define the system

- Build the model

- Run experiments

- Analyze the output

- Report results

Each step does not need to be completed in its entirety before moving on to the next step. Pritsker and Pagden observed the procedure for doing a simulation is an iterative one in which activities are refined and sometimes redefined with each iteration (1979).

<u>Step 1: Planning the Study</u>

Undefined objectives, unrealistic expectations, and a general lack of understanding of requirements frequently result from poor planning. Simulation should only be used if an objective can be clearly stated and it is determined that simulation is the most suitable tool for achieving the objective (PROMODEL® Corporation, 1996). The objective of this project was to validate the proposed staffing plans for the new MFHC.

Equally as important as defining objectives is identifying the constraints under which the study must be conducted (PROMODEL® Corporation, 1996). There was no budget for doing this project. The deadline for completing this project was

April 17, 1998 (seven and a half months from start to finish). Which in reality was one week a month for the first five months, three weeks during the sixth month, and two weeks the last month. The researcher was further occupied with a rigorous administrative residency in a civilian managed care company. The computers used for this project were located at NNMC, PHP Healthcare Corporation (location of administrative residency), and the researcher's private residence.

Defining a specification for the simulation is essential to projecting the time and cost that will be needed to complete the project (PROMODEL® Corporation, 1996). The scope of this model was confined to the activities which occurred within the MFHC. The level of detail was determined by the appreciable effect on the outcome of the model. Since the project modeled an almost completely new system, some accuracy was sacrificed until reliable information is available. The number and nature of the alternative solutions to be evaluated was limited due to time constraints of this project.

Step 2: Defining the System

This can be viewed as the development of a conceptual model on which the simulation model is based. The first step was to determine what data was required for building the model. This project required historical data from existing functions (physical examinations, military medicine, and occupational medicine) and ambulatory care standards and metrics for the new functions of the center. The standards and metrics were also used to predict future overall workload for the MFHC.

Carson noted that for a large-scale real system, there is seldom any one individual who understands how the system works in sufficient detail to build an accurate simulation model (1986). This project was the result of reviewing reports from the Primary Care Committee, historical patient data, conducting personal interviews, personal observations, site visits to other family health centers, and making lots of assumptions. In deciding whether to use a particular source of data, I considered the relevancy, reliability, and accessibility of the source. Many assumptions are only temporary until correct information can be obtained or until it is determined that more accurate information is necessary.

Historical data.

This project required historical data from existing functions (physical examinations, military medicine, and occupational medicine). For historical data of physical examinations conducted, which will continue on the 2nd Floor of the MFHC, the last three years of the Composite Health Care System (CHCS) Clinic Workload Report were examined. Table 1 (see Appendix A for a more complete report) reports that historically an average of 11 to about 13 physical examinations were conducted each work day (Monday through Wednesday and Friday).

Table 1

Average Physical Examinations (PEs) per Day

	AVG PEs per Day		
MONTH	1995	1996	1997
JAN	6.67	9.68	10.47
FEB	10.82	16.11	15.88
MAR	10.57	15.84	11.47
APR	12.00	11.15	13.70
MAY	13.75	6.63	11.94
JUN	15.53	8.67	11.47
JUL	18.39	10.30	8.50
AUG	15.29	13.50	10.58
SEP	13.56	16.17	11.42
OCT	15.05	15.05	11.84
NOV	11.67	12.94	10.24
DEC	6.94	7.95	6.14
TOTAL	12.57	11.97	11.06

For historical data of military medicine (sick call), which will continue at its new location on the 1st Floor of the MFHC, once again the last three years of the CHCS Clinic Workload Report were examined. Table 2 (see Appendix B for a more complete report) indicates that sick call visits have been on the decline and they now see approximately 42 patients per day (Monday through Friday).

Table 2

Average Patient (PT) Visits per Day

	AVG PTs per Day		
MONTH	1995	1996	1997
JAN	61.50	45.86	42.14
FEB	65.79	54.50	54.21
MAR	66.26	59.81	43.38
APR	63.05	63.00	42.32
MAY	60.50	52.36	45.86
JUN	63.36	54.65	37.33
JUL	55.70	50.45	37.86
AUG	61.48	48.18	33.05
SEP	61.30	50.10	41.76
OCT	68.14	47.86	41.73
NOV	53.65	45.89	44.22
DEC	51.75	39.19	44.45
TOTAL	61.13	51.03	42.23

Note. These numbers do not reflect the patient visits for physical examinations.

Converting sick call from the traditional "walk-in" basis to scheduled

appointments occurred during 1996. Table 3 (see Appendix C for a more complete

report) shows the dramatic effects from the change in the process.

Table 3

Average Walk-ins per Day

MONTH	AVG Walk-ins per Day		
	1995	1996	1997
JAN	0.00	0.14	8.95
FEB	0.11	0.35	9.89
MAR	0.09	0.29	7.95
APR	0.15	11.45	15.14
MAY	0.18	21.36	19.86
JUN	4.64	19.20	16.29
JUL	0.95	22.86	15.95
AUG	0.74	10.14	14.67
SEP	1.15	11.90	18.81
OCT	0.43	10.82	22.18
NOV	0.95	8.95	19.00
DEC	0.28	12.67	6.45
TOTAL	0.82	10.95	14.59

Table 4 (see Appendix D for a more complete report) reports a rise in patients that are seen on a follow-up basis. From the most recent year in Appendices B and D, a follow-up attribute for military medicine patients in the model as 12 percent was established. Meaning that 12 percent of the active duty patients (excluding physical examinations, "Shots-only", and "Lab-only" patients entering the system will require utilization of the Follow-up Corpsman at the reception desk on the 1st Floor.

Table 4

Average Follow-up (F/U) Patients Seen per Day

MONTH	AVG F/Us per Day		
	1995	1996	1997
JAN	2.85	0.19	8.00
FEB	1.95	1.80	10.16
MAR	0.04	0.38	8.71
APR	0.10	0.18	5.95
MAY	0.32	0.00	5.38
JUN	0.95	0.00	3.57
JUL	2.00	0.00	3.23
AUG	1.22	9.09	3.48
SEP	0.60	9.25	4.57
OCT	0.29	8.59	3.36
NOV	1.55	8.16	3.28
DEC	1.40	5.24	2.14
TOTAL	1.08	3.54	5.11

Included on the 2nd Floor of the MFHC, is an immunizations section and satellite laboratory. For historical data of immunizations given, a years worth of section reports were examined. Table 5 indicates that historically an average of 31 immunizations were given each work day.

Table 5

Average Number of Immunizations Given

Month	# of Immunizations Given	# of Workdays	AVG # of Immunizations Given per Day
Apr-97	618	22	28.09
May-97	528	21	25.14
Jun-97	631	21	30.05
Jul-97	604	22	27.45
Aug-97	513	21	24.43
Sep-97	587	21	27.95
Oct-97	1,071	22	48.68
Nov-97	654	18	36.33
Dec-97	507	22	23.05
Jan-98	496	20	24.80
Feb-98	620	19	32.63
Mar-98	978	22	44.45
Total	7,807	251	31.09

For historical data of laboratory specimens drawn in the satellite laboratory, a

Laboratory Sign-in Sheet had to be utilized since the technicians were unable to

retrieve data in any other way specific to their location. Because they periodically

destroy these sheets, only limited data was able to be obtained. Table 6 indicates

that an average of 39 laboratory specimens were drawn each work day.

Table 6

Average Number of Laboratory Visits

Date	# of Lab Visits
27-Feb-98	28
2-Mar-98	71
3-Mar-98	44
4-Mar-98	20
5-Mar-98	*19
6-Mar-98	48
9-Mar-98	29
10-Mar-98	74
11-Mar-98	10
12-Mar-98	*14
13-Mar-98	48
16-Mar-98	10
17-Mar-98	49
18-Mar-98	37
AVG	39

Note. Data from the 5th and 12th of March 1998 were not used in the computation of the average since physical examinations are not conducted on Thursdays.

For historical data of occupational medicine conducted, which will continue on the 2nd Floor of the MFHC, I examined the last two years of their divisional workload reports. Table 7 reports that historically an average of about nine total patient visits occur each work day (Monday through Friday). It is assumed that this work load (level of effort) will continue with the enrollment and opening of the MFHC. Since these patients use staff, services, and waiting areas of the MFHC, they must be considered. This workload can be further divided into reasons for visits. Approximately five patients will be seen for Occupational Health Examinations (see Appendix E), three for physical examinations (see Appendix F), and one will be a "Walk-in" patient (see Appendix G).

Table 7

Occupational Medicine's Workload (Average Number of Patient (PT) Visits per Day.

MONTH	# of PT Visits	# of Workdays	AVG # of PT Visits per Day
Mar-96	269	21	12.81
Apr-96	248	22	11.27
May-96	237	22	10.77
Jun-96	335	20	16.75
Jul-96	199	22	9.05
Aug-96	211	22	9.59
Sep-96	164	20	8.20
Oct-96	192	22	8.73
Nov-96	187	19	9.84
Dec-96	122	21	5.81
Jan-97	172	21	8.19
Feb-97	128	19	6.74
Mar-97	141	21	6.71
Apr-97	170	22	7.73
May-97	132	21	6.29
Jun-97	249	21	11.86
Jul-97	177	22	8.05
Aug-97	171	21	8.14
Sep-97	130	21	6.19
Oct-97	174	22	7.91
Nov-97	127	18	7.06
Dec-97	70	22	3.18
Jan-98	159	20	7.95
Feb-98	166	19	8.74
TOTAL	4,330	501	8.64

Of the five patients presenting for Occupational Health Examinations, approximately one will be seen as a Consultation patient, two will be seen as Certification patients, and two will be Preliminaries patients. A Consultation patient is under medical surveillance for four or more programs (i.e., Hearing Conservation, Sight Conservation, etc.) and will require approximately 30 to 40 minutes of the Occupational Medicine Doctor's time. A Certification patient is under medical

surveillance for less than four programs and will require approximately 10 to 20 minutes of the Occupational Medicine Doctor's time. A Preliminaries patient presents for the purpose of completing the preliminaries for a physical examination. Therefore, nine patients were entered into the model; one for Consultation (at 7:45 AM [15 minutes prior to the appointment time]), two for Certification (one at 10:05 AM and the other 20 minutes later at random [15 minutes prior]), two for Preliminaries (both at 7:45 AM [15 minutes prior]), three for physical examinations (one at 8:25 AM [15 minutes prior] with the second arriving 40 minutes later randomly and the third at 12:45 PM [15 minutes prior]), and one "Walk-in" patient at 7:30 AM. With the exception of the "Walk-in" patient, the time factors are based on the current schedule. Since patient arrivals are independent of one another and there is a tendency of patients to arrive early or late, this model automatically adjusts each arrival's time randomly after the first arrival. This model samples from a normal distribution whose mean is zero and whose standard deviation represents the tendency of patients to arrive early or late. Randomizing the arrival rate of the "Walk-in" patient was not possible.

From the information in Appendix H, a follow-up attribute for occupational medicine patients in the model as one percent (26/2,025) was obtained. Meaning that one percent of the patients entering the system will require utilization of the Occupational Medicine Receptionist prior to their departure from the system.

Table 8 was provided by the Health Promotions Nurse in response to Occupational Exposure Workload (e.g., "Needle-stick" patients).

Table 8

Average Number of Occupational Exposure Patients (PTs) Seen per Day

Year	# of PT Visits	# of Workdays	AVG # of PT Visits per Day
1995	480	250	1.92
1996	355	252	1.41
1997	254	251	1.01

Note. In 1996, there was a reduction in 25 percent of the consultation of titers. Prior

to January 1997, an Occupational Exposure patient required a six-week, three-

month, and six-month follow-up. Since that time, the three-month follow-up was

discontinued.

For the reasons noted in Table 8, only one "Occupational Exposure" patient

was entered into the model. Randomizing the arrival rate of this one patient was not

possible.

Additionally, the MFHC personnel are responsible for two tasks outside their

primary work areas. First, two personnel are assigned daily (24 hours) to respond to

patient transports (via ambulance). To evaluate the impact of this requirement, one

year of patient transport records were examined. Only nine of the 12 monthly

summary sheets were available to complete Table 9. Historically, Table 9 indicates

that there is a requirement for about two patient transports per day.

Table 9

Average Number of Patient (PT) Transports per Day

Month	# of PT Transports	# of Workdays	AVG # of PT Transports per Day
May-97	48	31	1.55
Jun-97	39	30	1.30
Jul-97	44	31	1.42
Aug-97	41	31	1.32
Sep-97	49	30	1.63
Oct-97	47	31	1.52
Nov-97	51	30	1.70
Dec-97	--		
Jan-98	111	31	3.58
Feb-98	62	28	2.21
Total	492	273	1.80

Note. – indicates that data was unavailable for December 1997.

Historically, this has required the personnel to be out of their working area on

average, for about 97 minutes (see Appendix I). Appendix J provided the historical

information on the most frequent times of departure for the ambulance crew.

Therefore, a requirement to reduce staffing by two Corpsmen at 5:30 PM (1730), the

most frequent departure time and 10:30 AM (1030), one of two second most

frequent departure times was programmed into the model. The other second most

frequent departure time, 5:00 PM (1700), was not used in the model since NNMC

would triage or contract transports that occur after a patient transport team has

departed the facility. Furthermore, the model would not have the assets to respond

to the 5:30 requirement after responding to the 5:00 PM task.

The MFHC personnel are also responsible for providing two personnel daily

(24 hours) to respond to Aeromedical Evacuation patient arrivals at Andrew Air

Force Base. To evaluate the impact of this requirement, information contained in

their log book was examined (prior to this log, historical information was not kept). Appendix K indicates that this requirement averages at least one run per day for almost 156 minutes. Appendix L provided the information on most frequent times of departure for the patient transport crew. Therefore, a requirement to capture the two Medical Evacuation Corpsmen at 5:15 PM (1715) from availability to assist with patient care for approximately 156 minutes was entered into the model.

Personal observations.

To capture the essence of the system, many hours observing the different processes that occur in the MFHC were spent. First, the time it took to complete the various processes of the physical examination on the 2nd Floor were recorded. Appendix M is a summary of the information gathered. Next, the time it took to complete the various processes of the primary care patient visit seen on the 1st Floor were recorded. Appendix N is a summary of that information. Appendix N was also utilized to summarize the internist patient visit process. Other than examination time, the processes were the same as for the other primary care patient visit. The processes that varied for the pediatrician patient visit are included in Appendix O. Appendix O also contains the processes that varied for the gynecology nurse practitioner patient visit (i.e., breast exams, Pap smears, etc.).

Ambulatory care standards and metrics.

For a number of reasons, military beneficiaries (active duty service members, military retirees, and their family members) are heavier users of medical care than are comparable civilian populations. Table 10 illustrates the utilization rates found by a research and analysis team of RAND, and provides the ambulatory care

standard for this model (Hosek, Bennett, Buchanan, Marquis, McGuigan, Hanley,

Madison, Rastegar, & Hawes-Dawson, 1995).

Table 10

Average Outpatient Utilization in Military Population Compared to Civilian

Population.

Beneficiary Category	Military	Civilian
Active Duty (AD)	3.09	2.28
AD Family Members	3.84	2.92
Retirees (RET [<65])	4.37	3.49
RET Family Members	4.33	3.42
Medicare (>65)	5.70	4.51

Note. The current projected enrollment by beneficiary category plan for the MFHC

does not include Medicare (>65) eligible beneficiaries.

The current projected enrollment number by beneficiary category plan for

the MFHC include 6,000 active duty service members, 4,700 active duty family

members, and 500 other eligible beneficiaries ([retirees {<65}, family members of

retired {<65}, and survivors {<65}] NNMC, 1998). Table 11 provides the eligible

population estimates for the NNMC catchment area (Resource Analysis and

Planning System, Version 10.1, 1997).

Table 11

National Naval Medical Center Catchment Area Eligible Population by Age/Sex.

Age/Sex	Active Duty (AD)	AD Family Members	Retired (RET)	Family Members of RET	Survivors
00-04/M	--	1,577	--	183	16
05-14/M	--	3,092	--	1,357	44
15-17/M	--	679	--	750	27
18-24/M	3,719	619	23	1,131	50
25-34/M	5,472	278	188	54	34
35-44/M	5,369	268	1,219	82	15
45-64/M	2,407	216	9,525	76	27
65+/M	--	24	7,149	29	14
00-04/F	--	1,533	--	187	6
05-14/F	--	2,946	--	1,241	41
15-17/F	--	637	--	717	20
18-24/F	811	1,326	4	1,192	59
25-34/F	1,270	2,506	31	270	29
35-44/F	1,235	2,481	166	1,615	70
45-64/F	374	1,385	246	8,433	732
65+/F	--	67	161	4,410	2,361
Total	20,657	19,634	18,712	21,727	3,545

Note. - - indicates data not available.

Since the current projected enrollment plan for the MFHC include total

beneficiary category numbers only, the assumption that the enrollees will have the

same demographics as the catchment area population was made. Table 12 is the

assumed demographics of the MFHC enrollees.

Table 12

Assumed Military Family Health Center Enrollment Population by Age/Sex.

Age/Sex	Active Duty (AD)	AD Family Members	Others (<65)	Total
00-04/M	--	377	3	380
05-14/M	--	740	23	763
15-17/M	--	163	13	176
18-24/M	1,080	148	20	1,248
25-34/M	1,589	67	5	1,661
35-44/M	1,559	64	22	1,645
45-64/M	699	52	161	912
65+/M	--	6		6
00-04/F	--	367	3	370
05-14/F	--	705	22	727
15-17/F	--	152	12	164
18-24/F	236	317	21	574
25-34/F	369	600	6	975
35-44/F	359	594	31	984
45-64/F	109	332	158	599
65+/F	--	16		16
Total	6,000	4,700	500	11,200

Note. - - indicates data not available. Others (<65) includes beneficiary categories

retirees (<65), family members of retired (<65), and survivors (<65).

Using the information in Tables 10 through 12, the MFHC enrollees total

annual outpatient visits per year in Table 13 was predicted.

Table 13

Predicted Total Annual Outpatient Visits per Year (OPV/YR).

Beneficiary Category	# of Enrollees	Utilization (AVG OPV/YR)	Total OPV/YR
Active Duty (AD)	6,000	3.09	18,540
AD Family Members	4,700	3.84	18,048
Others (<65)	500	4.33/4.35/4.37*	2,173
Total	11,200		38,761

Note. The formula used for computations was: Total Outpatient Visits per Year =

Number of Enrollees x Utilization. * indicates that the utilization rates used in this

computation included 4.37 for the 190 projected retired enrollees, 4.33 for the 290

projected family member of retired enrollees, and 4.35 (average of previous two

rates) for the 20 projected survivor enrollees.

Additionally, the Enrollment Based Capitation Program Linking Annual

Network Needs and Enrollment Resourcing (EBC PLANNER), Version 1.3, was

imputed using the same demographic methodology of Table 12, used NNMC's

actual historical workload, and produced a Data Validation Report indicating

38,672 total annual outpatient visits per year for the MFHC. The EBC PLANNER was

developed by the Office of the Assistant Secretary of Defense for Health Affairs to

allow commanders and their staff to determine where best to use limited resources

in supporting their Prime enrollees while meeting their military medical missions.

(Office of the Assistant Secretary of Defense for Health Affairs, 1998). Since 38,672

total annual outpatient visits per year was based on the actual historical workload of

NNMC, this figure along with the information in Table 13 was used to produce the

following table.

Table 14

Corrected Predicted Total Annual Outpatient Visits per Year (OPV/YR).

Beneficiary Category	Previously Predicted Total OPV/YR	Corrected Predicted Total OPV/YR
Active Duty (AD)	18,540	18,497
AD Family Members	18,048	18,007
Others (<65)	2,173	2,168
Total	38,761	38,672

Note. Computations are based on percentages of previously predicted total

outpatient visits per year by beneficiary category.

Projected workload.

The 18,497 total active duty service members outpatient visits per year

projected, represents an approximate 29 percent increase in active duty workload

from 1997 and the 38,672 total outpatient visits per year represents an approximate

66 percent increase in overall workload from 1997 (refer to Appendices A and B).

Historically, physical examinations have been on the rise between 16 to 19

percent of total patient visits for the last three years (refer to Appendices A and B).

Therefore, an annual total physical examination workload of 3,541 or 16 physicals

per day (Monday through Wednesday and Friday) was projected (using 19 percent).

Other beneficiary category physical examinations workloads were unable to be

predicted and therefore, considered regular primary care (sick call) visits. Therefore,

16 physical examination patients were entered into the model commencing at 7:30

AM with arrival rates of every 30 minutes (randomly) in groups of four. The time

factors are based on the current schedule.

From the demographics in Table 12 and total beneficiary category outpatient

visits per year in Table 14, 9,954 total pediatric and adolescent medicine primary

care visits or 40 visits per day (Monday through Friday) was predicted. Therefore, 40

pediatric and adolescent medicine patients were entered into the model (seven

commencing at 8:45 AM (15 minutes early) with arrival rates of every 20 minutes

(randomly) and 33 commencing at 12:45 PM (15 minutes early) with arrival rates of

every 20 minutes (randomly). To show the impact that accompanying family

members have on the size of the waiting rooms, a technique using a distribution

table to determine how many (0-1) family members accompany the patient

(including accompanying adult) was used. Graphically, the standard patient (no

additional family members besides the accompanying adult) is a mother holding an

infant. The distributions are based on observations in Table 15. The time factors are

based on the current schedule. Currently, the MFHC Pediatrician sees 15 patients

daily on Mondays and Wednesdays, and sees seven patients daily on Tuesday and

Friday mornings.

Table 15

Pediatric Patient Arrival Observations

Observation	Percentage
Child with accompanying adult	63
Child with accompanying adult plus one	37

After reviewing the demographics in Table 12, a requirement for at least

3,148 annual women's health needs visits for breast exams and Pap smears or 13

visits per day (Monday through Friday) was predicted. Therefore, 13 women's

health needs patients were entered into the model commencing at 12:45 PM (15

minutes early) with arrival rates of every 30 minutes (randomly). The time factors

are based on the current schedule. Currently, a gynecology nurse practitioner visits

the MFHC on Tuesday afternoons and Thursday mornings seeing a total of 12

patients a week.

Additionally, using the 35 percent "Walk-in" patient rate established in 1997

in Appendices B and C and the information in Table 14 (excluding physical

examinations and women's health needs visits), a 4,795 yearly "Walk-in" patients or 19 "Walk-ins" per day (Monday through Friday) was able to be predicted. Based on over 20 years healthcare personal experience, many hours of observing patients arriving for sick call, demonstration models by MedModel®, and knowing that the users of the system are transient by occupation and are use to the traditional method, 19 "Walk-in" type patients were entered into the model (13 within the first hour of the previously scheduled morning sick call commencing at 7:30 AM [randomly] and six within the first hour of the previously scheduled afternoon sick call commencing at 1:00 PM [randomly]). The time factors are based on the current schedules. Other beneficiary category "Walk-in" rates were unable to be predicted.

This still leaves a potential to see 17,234 primary care visits annually (after excluding 3,541 physical examinations, 3,148 women's health needs visits, 9,954 total pediatric and adolescent medicine primary care visits, and 4,795 "walk-ins") or 69 patients daily (Monday through Friday).

Additionally, the MFHC Internists see approximately 24 patient daily (Monday through Friday). Therefore, 24 internal medicine visits were entered into the model, six commencing at 8:15 AM (15 minutes early) with arrival rates of every 30 minutes (randomly), 12 commencing at 12:45 PM (15 minutes early) with arrival rates of every 30 minutes (randomly) in groups of two, two commencing at 3:45 AM (15 minutes early) with arrival rates of every 30 minutes (randomly), and four commencing at 5:45 AM (15 minutes early) with arrival rates of every 30 minutes (randomly). To again demonstrate the impact that accompanying family members have on the size of the waiting rooms, a technique using a distribution of

a 50 percent chance that a family member would accompany the patient. The time factors are based on the current schedule.

With the daily internal medicine visits known (24), the daily "Routine" (patients with appointments) visits could be determined (69 minus 24). Therefore, using Appendix P (typical provider schedule), 45 "Routine" primary care visits were entered into the model (nine commencing at 8:25 AM [15 minutes early] with arrival rates of every 20 minutes [randomly], three commencing at 8:45 AM [15 minutes early] with arrival rates of every 20 minutes [randomly], four commencing at 8:45 AM [15 minutes early] with arrival rates of every 40 minutes [randomly], four commencing at 10:05 AM [15 minutes early] with arrival rates of every 40 minutes [randomly] in groups of two, ten commencing at 1:25 PM [15 minutes early] with arrival rates of every 20 minutes [randomly] in groups of two, four commencing at 1:25 PM [15 minutes early] with arrival rates of every 20 minutes, three commencing at 1:25 PM [15 minutes early] with arrival rates of every 20 minutes, three at 1:25 PM [15 minutes early], two commencing at 3:25 PM [15 minutes early] with arrival rates of every 40 minutes, and three commencing at 6:05 PM [15 minutes early] with arrival rates of every 40 minutes).

Also the immunizations given workload from Table 5 was increased by 29 percent to predict 10,081 immunizations given per year or 40 immunizations given per day (Monday through Friday). Other beneficiary category immunizations requirements were unable to be predicted and it was assumed the pediatric immunizations would continue it its previous location outside the MFHC. Therefore, 24 "Shots-only" patients (subtracting the 16 physical examination

patients that would pass through as part of the physical examination process) were entered into the model commencing at 7:30 AM with the majority (16) patients arriving randomly about every 17 minutes during the morning and the remaining eight patients arriving randomly about every 22 minutes. The time factors are once again based on personal experience and observations, and demonstration models by MedModel®.

However, the satellite laboratory's specimens drawn workload in Table 6 was increased by 66 percent to predict a daily (Monday through Friday) specimens drawn rate of 65. Therefore, 49 "Labs-only" patients (subtracting the 16 physical examination patients that would pass through as part of the physical examination process) were entered into the model commencing at 7:30 AM with the majority (32) patients arriving randomly about every eight minutes during the morning and the remaining 17 patients arriving randomly about every 11 minutes in the afternoon. The time factors are once again based on personal experience and observations, and demonstration models by MedModel®.

Step 3: Building the Model

The goal of model building is to provide a valid representation of the defined system of operation (PROMODEL® Corporation, 1996). Law and Kelton advised that although there are few firm rules on how one should go about the modeling process, one point on which most authors agree is that it is always a good idea to start with a simple model which can later be more sophisticated if necessary. A model should contain only enough detail to capture the essence of the system for the purposes for which the model is intended. It is not necessary to have a one-to-

one correspondence between elements of the model and elements of the system. A

model with excessive detail may be too expensive to program and to execute

(1991). This model was built in phases in which additional sections (functions) were

added incrementally. First, computer aided drawings (CAD) of the floor-plans of

Floors 1 and 2 of Building 7 were converted side-by-side to be an appropriate

background for the model. The Grid Size was set to the known layout distance

(each grid unit equals one square foot). Simple background graphics were added to

enhance the model (see Appendix Q). Next, locations were added to represent fixed

places in the system where entities are routed for processing, or some other activity

or decision. This model contained 110 separate locations. Anything that a model

processes is called an "Entity" (PROMODEL® Corporation, 1996). Multiple graphics

were selected to represent the various entities in action (e.g. standing, sitting, and

lying-down). Additionally, these graphics were sized to match the background. This

model contained 24 entities. Path networks were developed to enable travel

between locations (See Appendix R). A resource is a person, piece of equipment, or

some other device used for any one or more of the following functions: treating or

moving patients, assisting in performing tasks for entities at locations, performing

maintenance on or for locations or other resources (PROMODEL® Corporation,

1996). Multiple graphics were selected to represent the various resources in action

as well. These graphics were also sized to match the background. This model

contained over 35 different resources. "Processing" defines everything that happens

to an entity from the time it enters a system until it exits (refer to Appendices M

through O [PROMODEL® Corporation, 1996]). Therefore, processing or operation

logic was developed for every entity included in this model. Finally, start and stop parameters were set.

The process of demonstrating that a model works as intended is referred to in simulation literature as model verification. MedModel® provides a trace capability in the form of an audit trail, screen messages, and graphic animation. A trace enables the user to look inside of the simulation to see if the simulation is performing the way it should.

The process of determining the degree to which the model corresponds to the real system, or at least accurately represents the model specification, is referred to as model validation (PROMODEL® Corporation, 1996). Providing absolute validity is a non attainable goal according to Neelamkavil. "True validation is a philosophical impossibility and all we can do is either invalidate or 'fail to invalidate' (1987)." For this reason, a high degree of face validity was sought. Face validity means that, from all outward indications, the model appears to be an accurate representation of the system (PROMODEL® Corporation, 1996). According to Schlesinger, validating a model is the process of substantiating that the model, within its domain of applicability, is sufficiently accurate for the intended application (1979). Validation is an inductive process in which the modeler draws conclusions about the accuracy of the model based on the evidence available (PROMODEL® Corporation, 1996). The output results were analyzed to see if the results appeared reasonable.

Step 4: Conducting Experiments

Simulation is basically an application of the scientific method. In simulation, the user begins with a theory of why certain design rules or management strategies are better than others. Based on these theories, the designer develops a hypothesis which he or she tests through simulation. Based on the results of the simulation the designer draws conclusions about the validity of his or her hypothesis. In a simulation experiment there are input variables defining the model which are independent and may be manipulated or varied. The effects of this manipulation on other dependent or response variables are measured and correlated (PROMODEL® Corporation, 1996). In other words, the validity of the current staffing plan was tested. Using different amounts of resources were experimented with and the results reported.

As with any experiment involving a system having random characteristics, the results of the simulation were also random in nature. The results of a single simulation run represent only one of several possible outcomes. This required that multiple replications be run to test the reproducibility of the results. Since simulation utilizes a pseudo-random number generator for generating random numbers, running the simulation multiple times simply reproduces the same sample (PROMODEL® Corporation, 1996).

As part of setting up the simulation experiment, a decision to decide what type of simulation to run (terminating or non-terminating) was made. A terminating simulation is one which the simulation starts at a defined state or time and ends when it reaches some other defined state or time. A non-terminating or steady-state

simulation is one which the steady-state behavior of the system is being analyzed

(PROMODEL® Corporation, 1996). A terminating simulation was chosen because

final performance counts and changing patterns of behavior over time rather than

the overall average behavior was of interest. For example, it would be inaccurate to

conclude that because two x-ray technicians are busy an average of 60 percent

during the day that only one x-ray technician is needed. This average measure

reveals nothing about utilization of the x-ray technicians during peak periods of the

day. A more detailed report of waiting times during the entire work day may reveal

that three x-ray technicians are needed to handle peak periods whereas only one x-

ray technician is necessary during off-peak hours. Hoover and Perry wrote that it is

often suggested in the simulation literature that an overall performance be

accumulated over the course of each replication of the simulation, ignoring the

behavior of the system at intermediate points in the simulation. They believed that

this is too simple an approach to collecting statistics when simulating a terminating

system. It reminded them of the statistician who had his head in the refrigerator and

feet in the oven, commenting that on the average he was quite comfortable (1990).

For terminating simulations, the three important questions to answer in running the

experiment are (PROMODEL® Corporation, 1996):

1. What should be the initial state of the model?

2. What is the terminating event or time?

3. How many replications to make?

The initial state selected for the model was without staff or patients (15 minutes

before the arrival of the first staff members). The terminating time selected for the

model was at the end of the day when staff had departed. Replications were chosen based on average workdays per year. For example, physical examinations were conducted 227 days in 1997, therefore the Physical Examinations Only Model was replicated 227 times or for one year to report the results.

<u>The Physical Examinations Only Model.</u>

The Physical Examinations Only Model provided the researcher a baseline report of one year 's equivalent (227 replications) data of the physical examination process with current resources and without competing processes. The current physical examination process involves the following staff resources:

- four providers

  - one family physician (civil service [validated]) 9:00 AM to 12:00 PM

  - one general medical officer (military [validated]) 9:00 AM to 12:00 PM

  - two nurse practitioners (civil service [validated]) 9:00 AM to 12:00 PM

- 16 hospital corpsmen (military)

  - one Leading Chief Petty Officer (supervisory and not involved in direct patient care-not used in model or validated)

  - one Leading Petty Officer (supervisory and not involved in direct patient care-not used in model or validated)

  - two working as appointment clerks (validated)

    - one 7:00 AM to 3:00 PM (lunch 11:00 AM to 12:00 PM)*

    - one 7:00 AM to 4:00 PM (lunch 12:00 PM to 1:00 PM)

  - three working as health records clerks(validated)

- two 7:00 AM to 3:00 PM (lunch 11:00 AM to 12:00 PM)*

- one 7:00 AM to 4:00 PM (lunch 12:00 PM to 1:00 PM)

- one working as a receptionist (validated)

  - 7:00 AM to 4:00 PM (lunch 12:00 PM to 1:00 PM)

- three working as medical assistants (validated)

  - one 7:00 AM to 3:00 PM (lunch 11:00 AM to 12:00 PM)*

  - one 7:00 AM to 4:00 PM (lunch 12:00 PM to 1:00 PM)

  - one 7:00 AM to 1200 AM (lunch 12:00 PM to 1:00 PM)**

- two working as laboratory technicians (validated)

  - one 7:00 AM to 3:00 PM (lunch 11:00 AM to 12:00 PM)*

  - one 7:00 AM to 4:00 PM (lunch 12:00 PM to 1:00 PM)

- two working as immunization technicians (validated)

  - one 7:00 AM to 3:00 PM (lunch 11:00 AM to 12:00 PM)*

  - one 7:00 AM to 4:00 PM (lunch 12:00 PM to 1:00 PM)

- one working as an office (physical examinations) clerk (validated)

  - 7:00 AM to 4:00 PM (lunch 12:00 PM to 1:00 PM)

The four providers are from existing assets on the 1st Floor and reduce the staffing levels of the 1st Floor during physical examinations. The military personnel whose shifts are completed at 3:00 PM (*) are involved in physical fitness training from 3:00 PM to 4:00 PM. The military person whose shift ends at 12:00 AM (**) actually is in a duty status (patient transports) and will continue to work until 3:00 PM the following day. Since this model only covers the activity of one day the duty person's shift ends at 12:00AM.

The Occupational Medicine Only Model.

The Occupational Medicine Only Model provided the researcher a baseline report of one year 's equivalent (251 replications) data of patients being seen in Occupational Medicine process with current resources and without competing processes. The current process involves the following staff resources:

- one occupational medicine physician (civil service [validated])

    - 7:00 AM to 3:30 PM (lunch 12:00 PM to 1:00 PM)

- one occupational health nurse (civil service [validated])

    - 6:30 AM to 4:00 PM (lunch 11:00 AM to 12:00 PM)

- two occupational health technicians (civil service [validated])

    - one 6:30 AM to 3:00 PM (lunch 11:00 AM to 12:00 PM)

    - one 7:00 AM to 3:30 PM (lunch 12:00 PM to 1:00 PM)

- one receptionist (civil service [validated])

    - 7:00 AM to 3:30 PM (lunch 11:00 AM to 12:00 PM)

- eight hospital corpsmen (military)

    - three working as health records clerks(validated)

        - shifts same as physical examinations only model

    - one working as a medical assistant (validated)

        - one 7:00 AM to 3:00 PM (lunch 11:00 AM to 12:00 PM)*

    - two working as laboratory technicians (validated)

        - shifts same as physical examinations only model

    - two working as immunization technicians (validated)

- shifts same as physical examinations only model

With the exception of the medical assistant, the hospital corpsmen are shared

resources with Physical Examinations.

The Physical Examinations and Occupational Medicine Only Model.

The Physical Examinations and Occupational Medicine Only Model

provided the researcher one year 's equivalent (251 replications) data of the

physical examination process and the occupational medicine patient visit process

sharing some current resources (health records clerks, laboratory technicians, and

immunization technicians) and locations (i.e., hearing test booths, vital sign stations,

waiting rooms, etc.) and the effects on resource utilization and patient waiting

times.

The Physical Examinations, Occupational Medicine, and "Labs Only" Patient

Model.

The Physical Examinations, Occupational Medicine, and "Labs Only" Patient

Model provided the researcher one year 's equivalent (251 replications) data of the

physical examination process, occupational medicine patient visit process, and

"labs only" patient sharing some current resources (health records clerks and

laboratory technicians) and locations (i.e., satellite laboratory, laboratory waiting

room, etc.) and the effects on resource utilization and patient waiting times.

The Physical Examinations, Occupational Medicine, and "Shots Only"

Patient Model.

The Physical Examinations, Occupational Medicine, and "Shots Only"

Patient Model provided the researcher one year 's equivalent (251 replications) data

of the physical examination process, occupational medicine patient visit process, and "shots only" patient sharing some current resources (health records clerks and immunizations technicians) and locations (i.e., immunizations, immunizations' waiting room, etc.) and the effects on resource utilization and patient waiting times.

The Physical Examinations, Occupational Medicine, "Labs Only," and "Shots Only" Patient Model.

The Physical Examinations, Occupational Medicine, "Labs Only," and "Shots Only" Patient Model provided the researcher one year 's equivalent (251 replications) data of the physical examination process, occupational medicine patient visit process, "labs only," and "shots only" patient sharing some current resources (health records clerks, laboratory technicians, and immunizations technicians) and locations (i.e., laboratory, immunizations, laboratory/ immunizations' waiting room, etc.) and the effects on resource utilization and patient waiting times.

Experiment 1: Using the Occupational Medicine Physician for Physical Examinations Model.

The Using the Occupational Medicine Physician for Physical Examinations Model provided the researcher one year 's equivalent (251 replications) data of the effects of using the Occupational Medicine Physician for the physical examinations process. The purpose of this experiment was to examine the feasibility of increasing utilization of the Occupational Medicine Physician and allowing General Medical Officer B to remain in patient care on the 1st Floor without compromising the occupational medicine patient visit or the physical examination process.

Experiment 2: Combining Assets on the 2nd Floor Model.

The Combining Assets on the 2nd Floor Model provided the researcher one year 's equivalent (251 replications) data of the effects of using the Occupational Medicine assets (two Occupational Health Technicians and Medical Assistant) for the physical examinations process too. While at the same time using the Physical Examinations assets (three medical assistants and receptionist) for the occupational medicine patient visit . The purpose of this experiment was to examine the feasibility of increasing utilization of the Occupational Medicine and Physical Examinations assets without compromising the occupational medicine patient visit or the physical examination process.

Experiment 3: Moving Occupational Medicine Preliminaries to the Afternoon Model.

The Moving Occupational Medicine Preliminaries to the Afternoon Model provided the researcher one year 's equivalent (251 replications) data of the effects of moving Occupational Medicine Preliminaries to the afternoon schedule. The purpose of this experiment was to examine the feasibility of increasing utilization of the Occupational Medicine and Physical Examinations assets by decreasing patient workload and process competition in the morning schedule without compromising the occupational medicine patient visit or the physical examination process.

Experiment 4: Moving Appointment Clerk to Medical Assistant Model.

The Moving Appointment Clerk to Medical Assistant Model provided the researcher one year 's equivalent (251 replications) data of the effects of moving one of the appointment clerks to add another medical assistant to the physical

examination process. The purpose of this experiment was to examine the feasibility of increasing utilization of Appointment Clerk B by changing him or her to Medical Assistant D without compromising the physical examination appointment process.

Experiment 5: Moving Occupational Medicine Medical Assistant to Physical Examinations Model.

The Moving Occupational Medicine Medical Assistant to Physical Examinations Model provided the researcher one year 's equivalent (251 replications) data of the effects of moving the medical assistant in Occupational Medicine to Physical Examinations. The purpose of this experiment was to examine the feasibility of increasing utilization of the medical assistant by being placed in Physical Examinations as Medical Assistant E D without compromising the occupational medicine patient visit process.

The 1st Floor MFHC Primary Care Visit Only Model.

The 1st Floor MFHC Primary Care Visit Only Model provided the researcher a baseline report of one year 's equivalent (251 replications) data of the general primary care visit process with current resources and without competing processes. The current process involves the following staff resources:

- eight providers
  - one Department Head (military family physician [validated]) 7:00 AM to 4:00 PM (lunch 12:00 PM to 1:00 PM)
  - one family physician (civil service [validated]) 8:00 AM to 4:30 PM (not available from 9:00 AM to 12:00 PM because of conducting physical examinations on the 2nd Floor and 12:00 PM to 1:00 PM for lunch)

- one general medical officer (military [validated]) 7:30 AM to 4:30 PM (lunch 12:00 PM to 1:00 PM)

- one general medical officer (military [validated]) 7:30 AM to 4:30 PM (not available from 9:00 AM to 12:00 PM because of conducting physical examinations on the 2nd Floor and 12:00 PM to 1:00 PM for lunch)

- one physician assistant (military [validated]) 12:00 PM to 8:00 PM (dinner 5:00 PM to 6:00 PM)

- two nurse practitioners (civil service [validated]) 7:00 AM to 3:30 PM (not available from 9:00 AM to 12:00 PM because of conducting physical examinations on the 2nd Floor and 12:00 PM to 1:00 PM for lunch)

- one independent duty corpsman (military [validated]) 7:00 AM to 4:00 PM (lunch 12:00 PM to 1:00 PM)

- five triage nurses
  - two military (validated)
    - one 7:00 AM to 3:00 PM (lunch 11:00 AM to 12:00 PM)*
    - one 7:00 AM to 4:00 PM (lunch 12:00 PM to 1:00 PM)
    - one civilian (validated) 9:00 AM to 5:30 PM (lunch 12:00 PM to 1:00 PM)
    - one military (validated) 11:30 AM to 8:30 PM (dinner 5:00 PM to 6:00 PM
    - one civilian (not used in model or validated) regular day off on schedule

- one Health Promotions Nurse (civilian-validated) 6:30 AM to 3:00 PM (lunch 11:00 AM to 12:00 PM)

- 31 hospital corpsmen (military)

  - one Department Leading Chief Petty Officer (supervisory and not involved in direct patient care-not used in model or validated)

  - one Department Leading Petty Officer (supervisory and not involved in direct patient care-not used in model or validated)

  - one Health Promotions Medical Assistant (not involved in direct patient care-not used in model or validated)

  - one Training Petty Officer (not involved in direct patient care-not used in model or validated)

  - one supply clerk (not involved in direct patient care-not used in model or validated)

  - three working as health records clerks (validated) located on 2nd Floor

    - two 7:00 AM to 3:00 PM (lunch 11:00 AM to 12:00 PM)*

    - one 7:00 AM to 4:00 PM (lunch 12:00 PM to 1:00 PM)

  - four working as receptionists (validated)

    - one 7:00 AM to 3:00 PM (lunch 11:00 AM to 12:00 PM)*

    - two 7:00 AM to 4:00 PM (lunch 12:00 PM to 1:00 PM)

    - one 11:30 AM to 8:30 PM (dinner 5:00 PM to 6:00 PM

  - ten working as medical assistants (validated)

    - four 7:00 AM to 3:00 PM (lunch 11:00 AM to 12:00 PM)*

- three 7:00 AM to 4:00 PM (lunch 12:00 PM to 1:00 PM)

- one 7:00 AM to 1200 AM (lunch 12:00 PM to 1:00 PM)**

- two 11:30 AM to 8:30 PM (lunch 6:00 PM to 7:00 PM)

- five medical assistants (not validated)

    - two on regular leave

    - three on regular day off

- four aeromedical evacuation corpsmen (used as medical assistants when

  not on transport)

    - one (not validated) regular day off

    - one 0530 AM to 1400 PM (lunch 11:00 AM to 12:00 PM)

    - one 7:00 AM to 3:00 PM (lunch 11:00 AM to 12:00 PM)*

    - one 1:30 PM to 10:00 PM (dinner 4:00 PM to 5:00 PM)

The military personnel whose shifts are completed at 3:00 PM (*) are involved in

physical fitness training from 3:00 PM to 4:00 PM. The military person whose shift

ends at 12:00 AM (**) actually is in a duty status (patient transports) and will

continue to work until 3:00 PM the following day. Since this model only covers

the activity of one day the duty person's shift ends at 12:00AM. In addition to the

eight providers, two Uniformed Services University of Health Sciences (USUHS)

general practice physicians were used because of being on the randomly selected

schedule:

- one 7:40 AM to 11:20 AM

- one 8:00 AM to 2:40 PM (lunch 12:00 PM to 1:00 PM)

The Internal Medicine Only Model.

The Internal Medicine Only Model provided the researcher a baseline report of one year 's equivalent (251 replications) data of patients being seen by the MFHC internists with current resources and without competing processes. The current process involves the following staff resources:

- two internists (military [validated])

    - one 8:30 AM to 4:00 PM (lunch 12:00 PM to 1:00 PM)

    - one 1:00 PM to 8:00 PM (dinner 5:00 PM to 6:00 PM)

- four receptionists shared with the 1st Floor MFHC Only Model

- ten medical assistants shared with the 1st Floor MFHC Only Model

- two triage nurses shared with the 1st Floor MFHC Only Model

The Pediatrics Only Model.

The Pediatrics Only Model provided the researcher a baseline report of one year 's equivalent (251 replications) data of patients being seen by the pediatrician with current resources and without competing processes. The current process involves the following staff resources:

- one pediatrician (military [validated]) 9:00 AM to 3:40 PM (lunch 12:00 PM to 1:00 PM)

- four receptionists shared with the 1st Floor MFHC Only Model

- ten medical assistants shared with the 1st Floor MFHC Only Model

- two triage nurses shared with the 1st Floor MFHC Only Model

The Women's Health Needs Only Model.

The Women's Health Needs Only Model provided the researcher a baseline report of one year 's equivalent (251 replications) data of patients being seen by the gynecology nurse practitioner with current resources and without competing processes. The current process involves the following borrowed resources:

- one gynecology nurse practitioner (civilian [validated]) 1:00 PM to 4:00 PM

- three staff health records clerks shared with the 1st and 2nd Floor processes

- four staff receptionists shared with the 1st Floor MFHC Only Model

- nine staff medical assistants shared with the 1st Floor MFHC Only Model

The MFHC Model.

The MFHC Model provided the researcher a baseline report of one year 's equivalent (251 replications) data of patients being seen by the entire MFHC with current resources and with all the competing processes of the 1st and 2nd Floors.

Step 5: Analyzing the Output

Output analysis deals with drawing inferences about the actual system based on the simulation output (PROMODEL® Corporation, 1996). When conducting simulation experiments, extreme caution in interpreting the simulation results was used. Since the results of a simulation experiment are random (given the probabilistic nature of the inputs), an accurate measurement of the statistical significance of the output was necessary. With more than 60 combined years of experience in doing simulation modeling, Conway, Maxwell, and Worona caution that attaching a statistical significance to simulation output can create a delusion that the output results are either more or less significant than they really are. They

emphasize the practical, intuitive reading of simulation results. Their guideline is "if you can't see it with the naked eye, forget it (1986)."

<u>Ethical Considerations</u>

The most pressing ethical issue in this project was the confidentiality of patient information. Although this project was based on information such as type of patient visit, patient demographics and diagnosis, individual patient data was in aggregate. In addition, observations of care were limited to those procedures for which the patient consented to observation. In general, personal observation of individual patient care was not necessary.

Step 6: The Results

Overall, utilization of resources in the MFHC ranged from less than a

percent to 80 percent (μ = 29.88, σ = 20.11, df = 4, and p = 0.10). The

utilization of the providers in the MFHC ranged from six percent to 80 percent (μ =

37.66, σ = 19.10, df = 2, and p = 0.69). The utilization of the support staff in the

MFHC ranged from less than a percent to 65 percent (μ = 26.28, σ = 19.54, df =

4, and p = 0.17). In consultation with the staff of MedModel®, utilization rates of at

least 65 to 75 percent are optimum.

The Physical Examinations Only Model

Table 16

Percentage Utilization of Physical Examinations (PE) Resources.

Resource	Scheduled Hours	# of Times Used	Minutes Per Usage	% Utilization
Family Physician	3.11	4.73	32.31	81.32
General Medical Officer B	3.38	2.42	33.72	39.90
Nurse Practitioner A	3.42	3.68	33.89	58.89
Nurse Practitioner B	3.39	3.17	32.70	49.42
PE Appointment Clerk A	7.00	11.12	2.92	7.58
PE Appointment Clerk B	8.00	12.18	2.90	7.21
Health Records Clerk A	7.00	5.37	0.62	0.78
Health Records Clerk B	8.00	5.33	0.63	0.69
Health Records Clerk C	7.00	5.29	0.62	0.77
PE Receptionist	8.00	18.18	4.75	18.42
PE Medical Assistant A	7.01	27.47	6.83	44.41
PE Medical Assistant B	12.25	31.43	8.51	36.23
PE Medical Assistant C	8.00	24.02	5.96	28.98
Laboratory Technician A	8.00	8.47	9.02	15.58
Laboratory Technician B	7.00	7.53	8.72	15.47
Immunizations Technician A	7.26	8.77	16.32	29.50
Immunizations Technician B	8.21	7.07	17.59	23.90
PE Office Clerk	8.02	13.95	5.40	14.58

Table 17

States of Physical Examinations (PE) Resources by Percentage.

Resource	% In Use	% Travel to Use	% Travel to Park	% Idle
Family Physician	81.22	0.09	0.01	18.68
General Medical Officer B	39.77	0.13	0.02	60.08
Nurse Practitioner A	58.75	0.14	0.01	41.10
Nurse Practitioner B	49.37	0.05	0.00	50.58
PE Appointment Clerk A	7.60	- -	- -	92.40
PE Appointment Clerk B	7.31	- -	- -	92.69
Health Records Clerk A	0.78	- -	- -	99.22
Health Records Clerk B	0.69	- -	- -	99.31
Health Records Clerk C	0.77	- -	- -	99.23
PE Receptionist	17.83	0.58	0.34	81.24
PE Medical Assistant A	41.91	2.50	2.06	53.54
PE Medical Assistant B	34.32	1.91	1.60	62.17
PE Medical Assistant C	26.96	2.02	1.64	69.38
Laboratory Technician A	15.42	0.16	0.16	84.26
Laboratory Technician B	15.31	0.16	0.16	84.37
Immunizations Technician A	29.50	0.00	0.16	70.34
Immunizations Technician B	23.89	0.01	0.11	76.00
PE Office Clerk	14.58	- -	- -	85.42

Note. - - indicates no data.

Table 18

The Entity Activity of the Physical Examinations (PE) Only Model.

Entity	AVG Minutes in System	AVG Minutes in Move Logic	AVG Minutes Waiting for Resource	AVG Minutes in Operation	AVG Minutes Blocked
PE Appointment	3.35	0.00	0.01	2.94	0.41
PE Patient	209.66	10.59	6.79	127.47	64.81

Table 19

The Entity Activity by Percentages of the Physical Examinations (PE) Only Model.

Entity	% in Move Logic	% Wait for Resource	% in Operation	% Blocked
PE Appointment	0.00	0.22	88.62	11.16
PE Patient	5.19	3.28	61.79	29.73

The Occupational Medicine Only Model.

Table 20

Percentage Utilization of Occupational Medicine (OM) Resources.

Resource	Scheduled Hours	# of Times Used	Minutes Per Usage	% Utilization
OM Physician	7.50	6.48	30.90	38.68
Occupational Health (OH) Nurse	8.25	0.36	1.64	0.41
OH Technician A	7.25	11.92	3.38	10.42
OH Technician B	7.50	4.06	3.85	3.86
OM Receptionist	7.50	9.00	3.41	6.83
OM Medical Assistant	7.00	1.50	3.78	1.74
Health Records Clerk A	7.00	3.14	0.62	0.46
Health Records Clerk B	8.00	2.69	0.62	0.34
Health Records Clerk C	7.00	3.18	0.62	0.46
Laboratory Technician A	8.00	1.12	8.59	1.98
Laboratory Technician B	7.00	0.88	8.06	1.94
Immunizations Technician A	7.00	1.68	8.38	3.21
Immunizations Technician B	8.00	0.32	2.77	0.58

Table 21

States of Occupational Medicine (OM) Resources by Percentage.

Resource	% In Use	% Travel to Use	% Travel to Park	% Idle
OM Physician	38.62	0.06	0.06	61.26
Occupational Health (OH) Nurse	0.34	0.06	0.05	99.54
OH Technician A	8.95	1.47	1.21	88.37
OH Technician B	3.24	0.62	0.56	95.58
OM Receptionist	6.83	- -	- -	93.17
OM Medical Assistant	1.44	0.31	0.26	98.00
Health Records Clerk A	0.46	- -	- -	99.54
Health Records Clerk B	0.34	- -	- -	99.66
Health Records Clerk C	0.46	- -	- -	99.54
Laboratory Technician A	1.96	0.02	0.02	97.99
Laboratory Technician B	1.92	0.02	0.02	98.04
Immunizations Technician A	3.21	0.00	0.03	96.76
Immunizations Technician B	0.58	0.00	0.01	99.42

Note. - - indicates no data.

Table 22

The Entity Activity of the Occupational Medicine (OM) Only Model.

Entity	AVG Minutes in System	AVG Minutes in Move Logic	AVG Minutes Waiting for Resource	AVG Minutes in Operation	AVG Minutes Blocked
OM Preliminaries Patient	73.45	8.44	0.09	62.72	2.19
OM Consultation Patient	54.67	3.94	0.09	39.64	10.99
OM Certification Patient	31.72	3.81	0.94	19.94	7.02
OM PE Patient	60.28	4.89	0.08	37.67	17.65
OM "Walk-in" Patient	35.13	5.53	0.00	29.31	0.30

Table 23

The Entity Activity by Percentages of the Occupational Medicine (OM) Only Model.

Entity	% in Move Logic	% Wait for Resource	% in Operation	% Blocked
OM Preliminaries Patient	11.76	0.13	85.25	2.87
OM Consultation Patient	7.32	0.18	73.57	18.93
OM Certification Patient	13.47	1.53	69.45	15.56
OM PE Patient	8.53	0.07	63.32	28.08
OM "Walk-in" Patient	20.38	0.00	79.40	0.22

The Physical Examinations and Occupational Medicine Only Model

Table 24

Percentage Utilization of Physical Examinations (PE) and Occupational Medicine

(OM) Resources with Shared Resources.

Resource	Scheduled Hours	# of Times Used	Minutes Per Usage	% Utilization
Family Physician	3.16	4.72	33.14	80.52
General Medical Officer B	3.41	2.13	31.19	33.36
Nurse Practitioner A	3.44	3.48	33.72	55.49
Nurse Practitioner B	3.43	2.94	31.88	44.98
PE Appointment Clerk A	7.00	11.15	2.91	7.60
PE Appointment Clerk B	8.00	12.04	2.98	7.31
Health Records Clerk A	7.00	8.48	0.62	1.25
Health Records Clerk B	8.00	7.96	0.62	1.02
Health Records Clerk C	7.00	8.56	0.61	1.24
PE Receptionist	8.00	17.95	4.78	18.33
PE Medical Assistant A	7.00	27.10	6.54	42.26
PE Medical Assistant B	12.25	30.28	9.03	36.11
PE Medical Assistant C	8.00	23.61	6.19	29.15
Laboratory Technician A	8.00	9.59	9.95	18.65
Laboratory Technician B	7.00	8.41	9.08	17.74
Immunizations Technician A	7.15	9.56	15.66	32.54
Immunizations Technician B	8.12	8.28	15.90	25.48
PE Office Clerk	8.03	13.21	5.00	13.60
OM Physician	7.51	6.17	36.59	38.17
Occupational Health (OH) Nurse	8.25	0.12	0.43	0.11
OH Technician A	7.25	12.71	3.60	11.88
OH Technician B	7.50	3.90	3.50	3.48
OM Receptionist	7.50	9.00	3.41	6.83
OM Medical Assistant	7.00	0.73	1.85	0.67

Note. ▇ indicates shared resources.

Table 25

States of Physical Examinations (PE) and Occupational Medicine (OM) Resources by

Percentage.

Resource	% In Use	% Travel to Use	% Travel to Park	% Idle
Family Physician	80.45	0.07	0.00	19.48
General Medical Officer B	33.25	0.12	0.02	66.61
Nurse Practitioner A	55.37	0.12	0.01	44.50
Nurse Practitioner B	44.95	0.04	0.00	55.01
PE Appointment Clerk A	7.60	- -	- -	92.40
PE Appointment Clerk B	7.31	- -	- -	92.69
Health Records Clerk A	1.25	- -	- -	98.75
Health Records Clerk B	1.02	- -	- -	98.98
Health Records Clerk C	1.24	- -	- -	98.76
PE Receptionist	17.73	0.60	0.38	81.29
PE Medical Assistant A	39.86	2.41	2.08	55.66
PE Medical Assistant B	34.34	1.77	1.54	62.34
PE Medical Assistant C	27.11	2.03	1.55	69.30
Laboratory Technician A	18.47	0.18	0.18	81.18
Laboratory Technician B	17.56	0.18	0.18	82.08
Immunizations Technician A	32.54	0.00	0.18	67.28
Immunizations Technician B	25.47	0.01	0.13	74.39
PE Office Clerk	13.60	- -	- -	86.40
OM Physician	38.12	0.05	0.05	61.77
Occupational Health (OH) Nurse	0.09	0.02	0.01	99.88
OH Technician A	10.19	1.69	1.44	86.67
OH Technician B	2.90	0.58	0.48	96.04
OM Receptionist	6.83	- -	- -	93.17
OM Medical Assistant	0.55	0.13	0.10	99.23

Note. - - indicates no data.

Table 26

The Entity Activity of the Physical Examinations (PE) and Occupational Medicine

(OM) Only Model.

Entity	AVG Minutes in System	AVG Minutes in Move Logic	AVG Minutes Waiting for Resource	AVG Minutes in Operation	AVG Minutes Blocked
PE Appointment	3.35	0.00	0.01	2.94	0.41
PE Patient	219.81	10.53	6.27	135.42	67.58
OM Preliminaries Patient	155.92	9.83	0.37	100.52	45.21
OM Consultation Patient	55.28	3.83	0.09	39.72	11.64
OM Certification Patient	32.44	3.88	0.97	19.99	7.59
OM PE Patient	60.84	4.89	0.03	38.09	17.82
OM "Walk-in" Patient	40.34	5.52	0.00	34.70	0.11

Table 27

The Entity Activity by Percentages of the Physical Examinations (PE) and

Occupational Medicine (OM) Only Model.

Entity	% in Move Logic	% Wait for Resource	% in Operation	% Blocked
PE Appointment	0.00	0.22	88.62	11.16
PE Patient	4.90	2.87	62.44	29.79
OM Preliminaries Patient	6.62	0.14	65.36	27.88
OM Consultation Patient	7.07	0.18	73.15	19.60
OM Certification Patient	13.33	1.51	67.63	17.54
OM PE Patient	8.40	0.04	63.31	28.26
OM "Walk-in" Patient	19.72	0.00	79.88	0.40

The Physical Examinations, Occupational Medicine, and "Labs Only" Patient Model

Table 28

Percentage Utilization of Physical Examinations (PE) and Occupational Medicine

(OM) Resources with Shared Resources and Addition of "Labs Only" Patients.

Resource	Scheduled Hours	# of Times Used	Minutes Per Usage	% Utilization
Family Physician	3.18	4.77	32.89	80.25
General Medical Officer B	3.39	2.03	31.59	32.79
Nurse Practitioner A	3.49	3.49	34.64	55.93
Nurse Practitioner B	3.44	2.96	32.09	45.37
PE Appointment Clerk A	7.00	11.12	2.92	7.58
PE Appointment Clerk B	8.00	12.18	2.90	7.21
Health Records Clerk A	7.00	23.38	0.61	3.41
Health Records Clerk B	8.00	26.27	0.62	3.36
Health Records Clerk C	7.00	23.54	0.61	3.42
PE Receptionist	8.00	17.49	4.75	17.81
PE Medical Assistant A	7.00	27.26	6.80	43.90
PE Medical Assistant B	12.25	29.71	9.28	36.12
PE Medical Assistant C	8.00	24.23	5.62	27.91
Laboratory Technician A	8.03	37.02	8.83	66.76
Laboratory Technician B	7.05	28.88	9.09	59.60
Immunizations Technician A	7.13	9.63	15.74	32.96
Immunizations Technician B	8.16	8.24	16.09	25.41
PE Office Clerk	8.04	13.14	5.21	13.48
OM Physician	7.51	6.22	33.10	37.75
Occupational Health (OH) Nurse	8.25	0.08	0.14	0.05
OH Technician A	7.25	12.66	3.74	12.10
OH Technician B	7.50	3.86	3.45	3.40
OM Receptionist	7.50	9.00	3.41	6.83
OM Medical Assistant	7.00	0.82	2.23	0.81

Note. ████ indicates resources used for "Labs Only" patients.

Table 29

States of Physical Examinations (PE) and Occupational Medicine (OM) Resources by

Percentage.

Resource	% In Use	% Travel to Use	% Travel to Park	% Idle
Family Physician	80.19	0.06	0.01	19.74
General Medical Officer B	32.68	0.11	0.02	67.19
Nurse Practitioner A	55.80	0.13	0.01	44.05
Nurse Practitioner B	45.33	0.04	0.00	54.63
PE Appointment Clerk A	7.58	- -	- -	92.42
PE Appointment Clerk B	7.21	- -	- -	92.79
Health Records Clerk A	3.41	- -	- -	96.59
Health Records Clerk B	3.36	- -	- -	96.64
Health Records Clerk C	3.42	- -	- -	96.58
PE Receptionist	17.24	0.57	0.36	81.83
PE Medical Assistant A	41.50	2.40	2.00	54.10
PE Medical Assistant B	34.37	1.75	1.52	62.36
PE Medical Assistant C	25.80	2.11	1.58	70.51
Laboratory Technician A	66.15	0.61	0.61	32.64
Laboratory Technician B	59.02	0.57	0.56	39.84
Immunizations Technician A	32.96	0.00	0.18	66.86
Immunizations Technician B	25.40	0.01	0.13	74.46
PE Office Clerk	13.48	- -	- -	86.52
OM Physician	37.69	0.05	0.05	62.20
Occupational Health (OH) Nurse	0.03	0.01	0.01	99.95
OH Technician A	10.39	1.71	1.45	86.45
OH Technician B	2.82	0.58	0.47	96.13
OM Receptionist	6.83	- -	- -	93.17
OM Medical Assistant	0.67	0.14	0.12	99.07

Note. - - indicates no data.

Table 30

The Entity Activity of the Physical Examinations (PE), Occupational Medicine (OM),

and "Labs Only" Patient Model.

Entity	AVG Minutes in System	AVG Minutes in Move Logic	AVG Minutes Waiting for Resource	AVG Minutes in Operation	AVG Minutes Blocked
PE Appointment	3.32	0.00	0.01	2.90	0.41
PE Patient	218.27	10.61	6.15	133.37	68.14
"Labs Only" Patient	24.10	2.27	1.03	9.37	11.43
OM Preliminaries Patient	160.91	10.32	0.20	95.74	54.64
OM Consultation Patient	57.49	3.74	0.09	39.69	13.95
OM Certification Patient	38.64	3.81	1.03	19.90	13.90
OM PE Patient	63.92	4.89	0.13	37.76	21.15
OM "Walk-in" Patient	38.99	5.53	0.00	33.10	0.36

Table 31

The Entity Activity by Percentages of the Physical Examinations (PE), Occupational

Medicine (OM), and "Labs Only" Patient Model.

Entity	% in Move Logic	% Wait for Resource	% in Operation	% Blocked
PE Appointment	0.00	0.17	88.34	11.49
PE Patient	4.98	2.83	61.73	30.46
"Labs Only" Patient	10.82	4.59	43.73	40.85
OM Preliminaries Patient	6.71	0.10	60.72	32.46
OM Consultation Patient	6.72	0.17	71.00	22.10
OM Certification Patient	11.92	1.01	62.03	25.04
OM PE Patient	8.02	0.16	60.21	31.61
OM "Walk-in" Patient	19.86	0.00	79.67	0.47

The Physical Examinations, Occupational Medicine, and "Shots Only" Patient

Model

Table 32

Percentage Utilization of Physical Examinations (PE) and Occupational Medicine

(OM) Resources with Shared Resources and Addition of "Shots Only" Patients.

Resource	Scheduled Hours	# of Times Used	Minutes Per Usage	% Utilization
Family Physician	3.15	4.75	32.81	80.92
General Medical Officer B	3.40	1.97	29.72	30.89
Nurse Practitioner A	3.49	3.43	33.89	53.94
Nurse Practitioner B	3.42	2.71	31.24	41.50
PE Appointment Clerk A	7.00	11.22	2.93	7.64
PE Appointment Clerk B	8.00	12.10	2.87	7.10
Health Records Clerk A	7.00	15.44	0.62	2.28
Health Records Clerk B	8.00	16.99	0.61	2.15
Health Records Clerk C	7.00	15.56	0.62	2.28
PE Receptionist	8.00	17.18	4.73	17.45
PE Medical Assistant A	7.01	26.86	6.82	42.96
PE Medical Assistant B	12.25	29.99	9.07	36.02
PE Medical Assistant C	8.01	23.61	6.09	28.44
Laboratory Technician A	8.00	9.67	9.19	17.78
Laboratory Technician B	7.00	8.33	9.08	17.43
Immunizations Technician A	7.82	20.08	16.33	57.10
Immunizations Technician B	8.27	18.70	13.20	45.89
PE Office Clerk	8.04	12.79	5.28	13.17
OM Physician	7.53	6.14	37.19	37.80
Occupational Health (OH) Nurse	8.25	0.07	0.29	0.07
OH Technician A	7.25	12.49	3.52	11.47
OH Technician B	7.50	4.06	3.69	3.80
OM Receptionist	7.50	8.93	3.42	6.78
OM Medical Assistant	7.00	0.71	2.17	0.73

Note. ▇▇▇ indicates resources used for "Shots Only" patients.

Table 33

States of Physical Examinations (PE) and Occupational Medicine (OM) Resources by

Percentage.

Resource	% In Use	% Travel to Use	% Travel to Park	% Idle
Family Physician	80.86	0.06	0.00	19.07
General Medical Officer B	30.76	0.13	0.03	69.08
Nurse Practitioner A	53.84	0.10	0.01	46.05
Nurse Practitioner B	41.48	0.03	0.00	58.50
PE Appointment Clerk A	7.64	- -	- -	92.36
PE Appointment Clerk B	7.10	- -	- -	92.90
Health Records Clerk A	2.28	- -	- -	97.72
Health Records Clerk B	2.15	- -	- -	97.85
Health Records Clerk C	2.28	- -	- -	97.72
PE Receptionist	16.89	0.56	0.36	82.19
PE Medical Assistant A	40.59	2.38	2.05	54.99
PE Medical Assistant B	34.29	1.74	1.52	62.46
PE Medical Assistant C	26.43	2.01	1.56	70.00
Laboratory Technician A	17.60	0.18	0.18	82.04
Laboratory Technician B	17.25	0.18	0.18	82.40
Immunizations Technician A	57.06	0.03	0.33	42.57
Immunizations Technician B	45.82	0.07	0.24	53.87
PE Office Clerk	13.17	- -	- -	86.83
OM Physician	37.74	0.05	0.05	62.15
Occupational Health (OH) Nurse	0.06	0.01	0.01	99.92
OH Technician A	9.82	1.65	1.40	87.13
OH Technician B	3.20	0.60	0.52	95.68
OM Receptionist	6.78	- -	- -	93.22
OM Medical Assistant	0.60	0.13	0.10	99.17

Note. - - indicates no data.

Table 34

The Entity Activity of the Physical Examinations (PE), Occupational Medicine (OM),

and "Shots Only" Patient Model.

Entity	AVG Minutes in System	AVG Minutes in Move Logic	AVG Minutes Waiting for Resource	AVG Minutes in Operation	AVG Minutes Blocked
PE Appointment	3.29	0.00	0.01	2.89	0.39
PE Patient	224.36	10.42	6.12	131.99	75.82
"Shots Only" Patient	47.51	1.98	0.76	8.68	36.10
OM Preliminaries Patient	175.30	9.70	0.25	100.42	64.94
OM Consultation Patient	55.50	3.84	0.09	39.77	11.79
OM Certification Patient	46.95	3.76	3.01	20.00	20.17
OM PE Patient	62.90	4.89	0.11	37.53	20.37
OM "Walk-in" Patient	38.45	5.52	0.00	32.69	0.24

Table 35

The Entity Activity by Percentages of the Physical Examinations (PE), Occupational

Medicine (OM), and "Shots Only" Patient Model.

Entity	% in Move Logic	% Wait for Resource	% in Operation	% Blocked
PE Appointment	0.00	0.15	89.10	10.75
PE Patient	4.73	2.72	59.45	33.10
"Shots Only" Patient	5.29	1.62	22.57	70.52
OM Preliminaries Patient	5.83	0.12	58.41	35.64
OM Consultation Patient	7.06	0.18	72.91	19.85
OM Certification Patient	11.59	2.68	60.80	24.93
OM PE Patient	8.29	0.12	61.83	29.77
OM "Walk-in" Patient	19.78	0.00	79.82	0.40

The Physical Examinations, Occupational Medicine, "Labs Only," and "Shots Only"

Patient Model

Table 36

Percentage Utilization of Physical Examinations (PE) and Occupational Medicine

(OM) Resources with Shared Resources and Addition of "Labs Only" and "Shots

Only" Patients.

Resource	Scheduled Hours	# of Times Used	Minutes Per Usage	% Utilization
Family Physician	3.17	4.59	32.82	77.37
General Medical Officer B	3.38	1.90	29.56	30.23
Nurse Practitioner A	3.42	3.38	34.05	54.01
Nurse Practitioner B	3.41	2.69	31.32	41.24
PE Appointment Clerk A	7.00	11.23	2.87	7.54
PE Appointment Clerk B	8.00	11.98	2.92	7.17
Health Records Clerk A	7.00	30.57	0.61	4.43
Health Records Clerk B	8.00	34.68	0.62	4.43
Health Records Clerk C	7.00	30.22	0.62	4.43
PE Receptionist	8.00	16.69	4.65	16.69
PE Medical Assistant A	7.01	26.97	6.76	43.34
PE Medical Assistant B	12.25	29.62	9.40	36.23
PE Medical Assistant C	8.01	23.21	5.97	27.56
Laboratory Technician A	8.04	36.42	8.69	65.62
Laboratory Technician B	7.04	28.70	8.80	59.62
Immunizations Technician A	7.91	19.34	16.65	57.15
Immunizations Technician B	8.51	18.80	14.66	47.31
PE Office Clerk	8.02	12.49	5.10	12.66
OM Physician	7.52	6.18	36.42	37.98
Occupational Health (OH) Nurse	8.25	0.08	0.21	0.05
OH Technician A	7.25	12.51	3.55	11.65
OH Technician B	7.50	3.98	3.35	3.51
OM Receptionist	7.50	8.95	3.41	6.79
OM Medical Assistant	7.00	0.79	1.96	0.74

Note. ▓▓▓ indicates resources used for "Labs Only" and "Shots Only" patients.

Table 37

States of Physical Examinations (PE) and Occupational Medicine (OM) Resources by

Percentage.

Resource	% In Use	% Travel to Use	% Travel to Park	% Idle
Family Physician	77.32	0.04	0.00	22.63
General Medical Officer B	30.12	0.11	0.02	69.74
Nurse Practitioner A	53.91	0.11	0.00	45.98
Nurse Practitioner B	41.21	0.03	0.00	58.76
PE Appointment Clerk A	7.54	- -	- -	92.46
PE Appointment Clerk B	7.17	- -	- -	92.83
Health Records Clerk A	4.43	- -	- -	95.57
Health Records Clerk B	4.43	- -	- -	95.57
Health Records Clerk C	4.43	- -	- -	95.57
PE Receptionist	16.17	0.52	0.33	82.98
PE Medical Assistant A	41.01	2.33	2.01	54.65
PE Medical Assistant B	34.49	1.74	1.51	62.27
PE Medical Assistant C	25.62	1.94	1.56	70.88
Laboratory Technician A	65.02	0.60	0.59	33.79
Laboratory Technician B	59.05	0.56	0.56	39.82
Immunizations Technician A	57.12	0.03	0.32	42.54
Immunizations Technician B	47.23	0.07	0.23	52.46
PE Office Clerk	12.66	- -	- -	87.34
OM Physician	37.92	0.05	0.05	61.97
Occupational Health (OH) Nurse	0.04	0.01	0.01	99.94
OH Technician A	9.98	1.67	1.41	86.94
OH Technician B	2.90	0.60	0.50	96.00
OM Receptionist	6.79	- -	- -	93.21
OM Medical Assistant	0.61	0.13	0.10	99.16

Note. - - indicates no data.

Table 38

The Entity Activity of the Physical Examinations (PE), Occupational Medicine (OM),

"Labs Only," and "Shots Only" Patient Model.

Entity	AVG Minutes in System	AVG Minutes in Move Logic	AVG Minutes Waiting for Resource	AVG Minutes in Operation	AVG Minutes Blocked
PE Appointment	3.31	0.00	0.01	2.90	0.41
PE Patient	220.98	10.36	5.80	130.23	74.59
"Shots Only" Patient	50.91	1.99	0.71	8.47	39.74
"Labs Only" Patient	28.79	2.28	1.03	9.45	16.03
OM Preliminaries Patient	181.26	10.19	0.38	92.10	78.59
OM Consultation Patient	58.96	3.72	0.09	39.72	15.43
OM Certification Patient	51.55	3.91	2.28	19.92	25.44
OM PE Patient	66.64	4.89	0.13	37.64	23.99
OM "Walk-in" Patient	40.94	5.52	0.00	35.24	0.18

Table 39

The Entity Activity by Percentages of the Physical Examinations (PE), Occupational

Medicine (OM), "Labs Only," and "Shots Only" Patient Model.

Entity	% in Move Logic	% Wait for Resource	% in Operation	% Blocked
PE Appointment	0.00	0.16	88.64	11.20
PE Patient	4.76	2.61	59.53	33.09
"Shots Only" Patient	4.90	1.38	20.53	73.19
"Labs Only" Patient	9.73	3.93	39.55	46.78
OM Preliminaries Patient	5.93	0.16	52.53	41.38
OM Consultation Patient	6.52	0.17	69.40	23.91
OM Certification Patient	10.61	2.12	53.69	33.58
OM PE Patient	7.80	0.12	58.14	33.93
OM "Walk-in" Patient	20.11	0.00	79.49	0.40

The 1st Floor MFHC Primary Care Visit Only Model

Table 40

Percentage Utilization of 1st Floor MFHC Primary Care Visit Only Resources.

Resource	Scheduled Hours	# of Times Used	Minutes Per Usage	% Utilization
Health Records Clerk A	7.00	19.90	0.61	2.87
Health Records Clerk B	8.00	21.95	0.61	2.78
Health Records Clerk C	7.00	19.66	0.62	2.87
Receptionist A	7.00	23.94	4.44	24.66
Receptionist B	8.00	24.44	4.49	22.10
Receptionist C	6.80	7.58	3.98	7.12
Medical Assistant A	7.14	14.81	10.91	29.16
Medical Assistant B	12.25	17.90	12.46	25.66
Medical Assistant C	7.17	14.29	11.88	29.74
Medical Assistant D	8.29	16.52	13.01	31.95
Medical Assistant E	7.12	14.82	12.71	29.02
Medical Assistant F	7.09	14.68	19.86	27.96
Medical Assistant G	7.93	18.12	11.78	38.19
Medical Assistant H	7.88	17.66	12.33	35.90
Medical Assistant (PEDS)	8.05	3.59	11.26	6.53
Medical Assistant (GYN)	8.01	1.93	9.74	3.43
MEDEVAC HM A	6.25	0.02	0.07	0.02
MEDEVAC HM B	5.75	2.79	81.03	57.46
MEDEVAC HM C	8.00	0.41	1.08	0.31
Triage Nurse A	8.05	10.59	12.34	28.42
Triage Nurse B	7.03	9.31	12.57	28.11
Triage Nurse C	6.82	1.56	12.79	5.11
Triage Nurse D	7.51	1.98	7.77	2.77
Department Head	7.23	7.44	31.58	44.80
Family Practice Physician	5.07	7.93	33.68	57.81
General Medical Officer A	8.46	10.71	35.50	59.88
General Medical Officer B	3.91	4.97	34.58	59.37
Physician Assistant	6.01	3.85	23.32	21.24
Nurse Practitioner A	4.27	4.20	15.27	24.89
Nurse Practitioner B	4.25	3.20	15.87	20.33
Independent Duty Corpsman	6.34	4.48	11.58	13.35
Health Promotions Nurse	7.25	1.00	29.38	6.83
USUHS Physician A	4.19	6.84	31.38	71.88
USUHS Physician B	6.18	6.73	41.51	53.87
Check-out Receptionist	8.00	12.08	3.76	9.43

Table 41

States of the 1st Floor MFHC Primary Care Visit Only Resources by Percentage.

Resource	% In Use	% Travel to Use	% Travel to Park	% Idle
Health Records Clerk A	2.82	- -	- -	97.18
Health Records Clerk B	2.76	- -	- -	97.24
Health Records Clerk C	2.82	- -	- -	97.18
Receptionist A	23.98	- -	- -	76.02
Receptionist B	21.41	- -	- -	78.59
Receptionist C	7.45	- -	- -	92.55
Medical Assistant A	28.60	2.24	3.01	66.15
Medical Assistant B	23.61	1.76	2.33	72.30
Medical Assistant C	26.76	2.26	3.05	67.93
Medical Assistant D	29.77	2.28	3.03	64.93
Medical Assistant E	27.09	2.23	3.08	67.60
Medical Assistant F	27.44	2.17	2.97	67.42
Medical Assistant G	34.51	2.59	3.45	59.45
Medical Assistant H	35.07	2.47	3.37	59.08
Medical Assistant (PEDS)	7.35	0.63	0.76	91.26
Medical Assistant (GYN)	3.82	0.36	0.44	95.38
MEDEVAC HM A	0.01	0.00	0.00	99.98
MEDEVAC HM B	56.79	0.53	0.21	42.47
MEDEVAC HM C	0.36	0.07	0.06	99.51
Triage Nurse A	26.73	1.32	1.63	70.32
Triage Nurse B	26.80	1.30	1.62	70.28
Triage Nurse C	4.87	0.32	0.38	94.43
Triage Nurse D	2.72	0.17	0.21	96.90
Department Head	44.24	1.60	0.98	53.18
Family Practice Physician	58.65	0.06	0.06	41.23
General Medical Officer A	57.91	0.68	0.63	40.78
General Medical Officer B	55.97	2.14	1.97	39.92
Physician Assistant	21.02	0.34	0.33	78.32
Nurse Practitioner A	23.92	0.41	0.39	75.28
Nurse Practitioner B	18.97	0.44	0.43	80.16
Independent Duty Corpsman	12.93	0.06	0.06	86.96
USUHS Physician A	70.21	2.42	1.38	25.99
USUHS Physician B	50.79	1.48	0.81	46.93
Check-out Receptionist	9.04	- -	- -	90.96

Note. - - indicates no data.

Table 42

The Entity Activity of the 1st Floor MFHC Primary Care Visit Only Model.

Entity	AVG Minutes in System	AVG Minutes in Move Logic	AVG Minutes Waiting for Resource	AVG Minutes in Operation	AVG Minutes Blocked
Routine Patient	61.43	3.40	3.14	41.25	13.65
Walk-in Patient	77.45	4.20	1.95	51.68	19.63

Table 43

The Entity Activity by Percentages of the 1st Floor MFHC Primary Care Visit Only

Model.

Entity	% in Move Logic	% Wait for Resource	% In Operation	% Blocked
Routine Patient	5.75	4.96	68.13	21.16
Walk-in Patient	5.56	2.49	67.20	24.76

The Internal Medicine Only Model

Table 44

Percentage Utilization of Internal Medicine Visit Only Resources.

Resource	Scheduled Hours	# of Times Used	Minutes Per Usage	% Utilization
Receptionist A	7.00	6.80	3.64	5.71
Receptionist B	8.02	6.61	4.04	5.08
Receptionist C	6.76	7.52	3.98	6.50
Medical Assistant A	7.02	2.58	16.02	8.55
Medical Assistant B	12.25	6.30	62.39	33.60
Medical Assistant C	7.04	3.94	120.76	36.16
Medical Assistant D	8.36	6.28	59.60	26.50
Medical Assistant E	7.09	2.75	149.41	41.63
Medical Assistant F	7.11	4.82	43.85	20.17
Medical Assistant G	8.19	12.38	21.39	36.48
Medical Assistant H	8.28	12.10	21.93	7.18
Medical Assistant (PEDS)	8.00	0.16	1.01	0.24
Medical Assistant (GYN)	8.00	0.02	0.04	0.01
Triage Nurse C	6.77	0.57	21.45	5.65
Triage Nurse D	7.57	0.04	4.44	0.73
Internists A	6.76	9.22	26.16	59.17
Internists B	6.00	7.79	25.20	54.56
Check-out Receptionist	8.01	7.12	3.80	5.63

Table 45

States of Internal Medicine Visit Only Resources by Percentage.

Resource	% In Use	% Travel to Use	% Travel to Park	% Idle
Receptionist A	5.71	- -	- -	94.29
Receptionist B	5.08	- -	- -	94.92
Receptionist C	6.50	- -	- -	93.50
Medical Assistant A	8.24	0.31	0.53	90.91
Medical Assistant B	33.17	0.43	0.59	65.82
Medical Assistant C	35.65	0.51	0.70	3.14
Medical Assistant D	25.80	0.70	0.95	75.55
Medical Assistant E	41.30	0.34	0.48	57.89
Medical Assistant F	19.52	0.65	0.85	8.98
Medical Assistant G	35.13	1.35	1.81	1.71
Medical Assistant H	5.86	1.32	1.77	1.05
Medical Assistant (PEDS)	0.22	0.02	0.03	99.73
Medical Assistant (GYN)	0.01	0.00	0.00	99.99
Triage Nurse C	5.54	0.11	0.08	94.28
Triage Nurse D	0.73	0.01	0.00	99.26
Internists A	58.38	0.78	0.31	40.32
Internists B	53.92	0.64	0.21	45.24
Check-out Receptionist	5.63	- -	- -	94.37

Note. - - indicates no data.

Table 46

The Entity Activity of the Internal Medicine Only Model.

Entity	AVG Minutes in System	AVG Minutes in Move Logic	AVG Minutes Waiting for Resource	AVG Minutes in Operation	AVG Minutes Blocked
IM Patient	120.23	3.21	10.49	54.31	52.22

Table 47

The Entity Activity by Percentages of the Internal Medicine Only Model.

Entity	% in Move Logic	% Wait for Resource	% In Operation	% Blocked
IM Patient	2.86	8.98	46.20	41.96

The Pediatrics Only Model

Table 48

Percentage Utilization of the Pediatrics Only Model.

Resource	Scheduled Hours	# of Times Used	Minutes Per Usage	% Utilization
Receptionist A	7.00	5.29	3.84	4.31
Receptionist B	8.00	6.09	3.88	4.29
Receptionist C	6.76	7.51	3.82	6.82
Medical Assistant A	7.13	1.19	49.02	11.92
Medical Assistant B	12.25	3.85	52.55	22.20
Medical Assistant C	7.43	2.12	27.22	9.87
Medical Assistant D	8.56	3.53	29.86	12.27
Medical Assistant E	7.30	2.37	44.38	15.45
Medical Assistant F	7.36	2.22	49.44	17.12
Medical Assistant G	8.16	3.02	70.45	34.17
Medical Assistant H	8.12	2.67	84.25	33.11
Medical Assistant (PEDS)	9.94	15.47	19.61	42.06
Medical Assistant (GYN)	8.02	0.02	1.15	0.16
Triage Nurse C	6.76	0.06	6.53	1.54
Triage Nurse D	7.53	0.02	2.15	0.35
Pediatrician	6.21	10.52	34.99	91.33
Check-out Receptionist	8.00	2.46	3.28	1.87

Table 49

States of Pediatrics Visit Only Resources by Percentage.

Resource	% In Use	% Travel to Use	% Travel to Park	% Idle
Receptionist A	4.31	- -	- -	95.69
Receptionist B	4.29	- -	- -	95.71
Receptionist C	6.82	- -	- -	93.18
Medical Assistant A	11.78	0.13	0.15	87.93
Medical Assistant B	21.94	0.25	0.27	77.54
Medical Assistant C	9.61	0.25	0.30	89.83
Medical Assistant D	12.01	0.26	0.29	87.43
Medical Assistant E	15.25	0.20	0.21	84.34
Medical Assistant F	16.92	0.19	0.20	82.69
Medical Assistant G	33.96	0.21	0.18	65.65
Medical Assistant H	32.92	0.19	0.16	66.72
Medical Assistant (PEDS)	41.04	1.02	1.06	56.88
Medical Assistant (GYN)	0.16	0.00	0.00	99.84
Triage Nurse C	1.53	0.01	0.00	98.46
Triage Nurse D	0.35	0.00	0.00	99.65
Pediatrician	90.14	1.19	0.23	8.44
Check-out Receptionist	1.87	- -	- -	98.13

Note. - - indicates no data.

Table 50

The Entity Activity of the Pediatrics Only Model.

Entity	AVG Minutes in System	AVG Minutes in Move Logic	AVG Minutes Waiting for Resource	AVG Minutes in Operation	AVG Minutes Blocked
PEDS Patient	115.65	2.90	21.60	53.72	37.44

Table 51

The Entity Activity by Percentages of the Pediatrics Only Model.

Entity	% in Move Logic	% Wait for Resource	% In Operation	% Blocked
PEDS Patient	2.81	18.49	48.31	30.39

The Women's Health Needs Only Model

Table 52

Percentage Utilization of Women's Health Needs Only Resources.

Resource	Scheduled Hours	# of Times Used	Minutes Per Usage	% Utilization
Health Records Clerk A	7.00	1.98	0.65	0.30
Health Records Clerk B	8.00	3.91	0.61	0.50
Health Records Clerk C	7.00	1.98	0.60	0.28
Receptionist A	7.00	2.10	3.72	1.66
Receptionist B	8.00	2.85	3.79	2.01
Receptionist C	6.76	2.92	3.79	2.45
Medical Assistant A	7.03	1.07	102.15	24.48
Medical Assistant B	7.02	1.03	5.53	1.47
Medical Assistant C	7.02	1.03	5.53	1.47
Medical Assistant D	8.14	1.06	10.21	2.50
Medical Assistant E	7.01	0.85	4.20	1.18
Medical Assistant F	7.01	0.62	3.22	0.90
Medical Assistant G	7.91	1.41	48.41	13.71
Medical Assistant H	7.87	1.06	41.47	11.44
Medical Assistant (GYN)	8.54	17.29	7.49	23.82
GYN Nurse Practitioner	3.07	17.47	8.50	81.47
Check-out Receptionist	8.00	0.48	1.37	0.36

Table 53

States of the Women's Health Needs Only Resources by Percentage.

Resource	% In Use	% Travel to Use	% Travel to Park	% Idle
Health Records Clerk A	0.30	--	--	99.70
Health Records Clerk B	0.50	--	--	99.50
Health Records Clerk C	0.28	--	--	99.72
Receptionist A	1.66	--	--	98.34
Receptionist B	2.01	--	--	97.99
Receptionist C	2.45	--	--	97.55
Medical Assistant A	24.32	0.16	0.16	75.37
Medical Assistant B	3.11	0.07	0.08	13.71
Medical Assistant C	1.41	0.06	0.25	98.28
Medical Assistant D	2.44	0.05	0.21	97.29
Medical Assistant E	1.13	0.05	0.20	98.62
Medical Assistant F	0.86	0.03	0.14	98.96
Medical Assistant G	13.60	0.11	0.23	86.06
Medical Assistant H	11.36	0.08	0.17	88.39
Medical Assistant (GYN)	20.59	3.23	3.24	72.94
GYN Nurse Practitioner	79.29	2.18	0.37	18.17
Check-out Receptionist	0.36	--	--	99.64

Table 54

The Entity Activity of the Women's Health Needs Only Model.

Entity	AVG Minutes in System	AVG Minutes in Move Logic	AVG Minutes Waiting for Resource	AVG Minutes in Operation	AVG Minutes Blocked
GYN Patient	95.14	4.46	36.50	50.72	3.46

Table 55

The Entity Activity by Percentages of the Women's Health Needs Visit Only Model.

Entity	% in Move Logic	% Wait for Resource	% In Operation	% Blocked
GYN Patient	5.21	34.38	57.56	2.85

The MFHC Model

Table 56

Percentage Utilization of MFHC Resources.

Resource	Scheduled Hours	# of Times Used	Minutes Per Usage	% Utilization
Family Physician (PE Only)	3.17	4.67	33.55	80.12
General Medical Officer B (PE Only)	3.39	1.94	31.09	31.59
Nurse Practitioner A (PE Only)	3.46	3.49	33.40	54.80
Nurse Practitioner B (PE Only)	3.41	2.72	31.81	42.07
PE Appointment Clerk A	7.00	11.10	2.96	7.63
PE Appointment Clerk B	8.00	12.24	2.83	7.06
Health Records Clerk A	7.00	50.55	0.62	7.41
Health Records Clerk B	8.00	59.58	0.61	7.56
Health Records Clerk C	7.00	51.02	0.61	7.41
PE Receptionist	8.00	17.39	4.62	17.21
PE Medical Assistant A	7.00	27.75	6.72	44.01
PE Medical Assistant B	12.25	29.72	9.61	37.03
PE Medical Assistant C	8.00	23.35	6.35	29.01
Laboratory Technician A	8.07	36.02	8.84	65.32
Laboratory Technician B	7.03	28.04	8.96	59.42
Immunizations Technician A	8.88	18.40	23.14	63.24
Immunizations Technician B	8.43	17.85	14.29	45.28
PE Office Clerk	8.07	12.65	6.81	14.82
OM Physician	7.50	6.18	30.46	36.86
Occupational Health (OH) Nurse	8.25	0.12	0.22	0.06
OH Technician A	7.25	12.34	3.40	11.04
OH Technician B	7.50	4.09	3.56	3.75
OM Receptionist	7.50	8.92	3.37	6.67
OM Medical Assistant	7.00	0.96	2.91	1.10
Receptionist A	7.02	26.98	4.34	26.64
Receptionist B	8.01	29.12	4.26	24.95
Receptionist C	6.77	12.58	3.60	11.36
Medical Assistant A	7.31	14.03	20.99	43.35
Medical Assistant B	12.26	18.04	20.69	36.68
Medical Assistant C	7.37	13.73	19.15	39.33
Medical Assistant D	8.53	17.25	17.85	41.52
Medical Assistant E	7.17	12.05	26.39	41.94
Medical Assistant F	7.19	12.69	24.12	41.40
Medical Assistant G	8.17	18.75	17.45	48.59
Medical Assistant H	8.17	18.30	16.08	49.37
Medical Assistant (PEDS)	9.42	15.89	18.25	40.45

Medical Assistant (GYN)	8.20	11.29	9.02	18.05
MEDEVAC HM A	6.26	0.53	3.07	1.17
MEDEVAC HM B	5.82	4.30	62.67	60.61
MEDEVAC HM C	8.09	1.61	6.45	2.13
Triage Nurse A	8.85	9.87	23.34	39.98
Triage Nurse B	7.49	8.12	20.37	32.12
Triage Nurse C	6.89	2.90	20.40	14.76
Triage Nurse D	7.73	2.74	15.27	9.22
Department Head	7.16	4.62	30.31	28.66
Family Practice Physician	4.93	5.75	31.60	48.88
General Medical Officer A	8.21	8.44	33.09	45.85
General Medical Officer B	3.72	3.92	33.74	45.64
Physician Assistant	6.01	3.00	20.15	17.02
Nurse Practitioner A	4.25	2.69	13.60	16.01
Nurse Practitioner B	4.23	1.79	13.04	11.52
Independent Duty Corpsman	6.34	2.06	10.45	6.21
Health Promotions Nurse	7.25	1.00	29.38	6.83
USUHS Physician A	4.13	4.87	34.42	53.21
USUHS Physician B	5.80	4.03	31.78	30.71
Internists A	6.58	6.22	25.68	40.76
Internists B	7.00	3.52	25.13	21.38
Pediatrician	6.00	8.27	34.84	73.22
GYN Nurse Practitioner	3.03	6.90	6.40	31.08
Check-out Receptionist	8.00	14.63	5.26	11.86

Table 57

States of MFHC Resources by Percentage.

Resource	% In Use	% Travel to Use	% Travel to Park	% Idle
Family Physician (PE Only)	80.07	0.05	0.00	19.88
General Medical Officer B (PE Only)	31.47	0.13	0.02	68.39
Nurse Practitioner A (PE Only)	54.70	0.10	0.01	45.18
Nurse Practitioner B (PE Only)	42.04	0.03	0.00	57.92
PE Appointment Clerk A	7.63	--	--	92.37
PE Appointment Clerk B	7.06	--	--	92.94
Health Records Clerk A	7.41	--	--	92.59
Health Records Clerk B	7.56	--	--	92.44
Health Records Clerk C	7.41	--	--	92.59
PE Receptionist	16.65	0.55	0.34	82.46
PE Medical Assistant A	41.60	2.41	1.94	54.04
PE Medical Assistant B	35.31	1.72	1.47	61.50
PE Medical Assistant C	27.00	2.01	1.58	69.41
Laboratory Technician A	64.73	0.58	0.58	34.11
Laboratory Technician B	58.87	0.55	0.54	40.04
Immunizations Technician A	63.22	0.03	0.28	36.48
Immunizations Technician B	45.21	0.07	0.22	54.50
PE Office Clerk	14.82	--	--	85.18
OM Physician	36.80	0.05	0.05	63.09
Occupational Health (OH) Nurse	0.04	0.02	0.01	99.93
OH Technician A	9.39	1.65	1.33	87.62
OH Technician B	3.13	0.62	0.54	95.71
OM Receptionist	6.67	--	--	93.33
OM Medical Assistant	0.92	0.18	0.15	98.75
Receptionist A	26.64	--	--	73.36
Receptionist B	24.95	--	--	75.05
Receptionist C	11.36	--	--	88.64
Medical Assistant A	41.37	1.98	2.67	53.99
Medical Assistant B	35.10	1.58	2.05	61.27
Medical Assistant C	37.37	1.96	2.62	58.05
Medical Assistant D	39.36	2.16	2.88	55.61
Medical Assistant E	40.22	1.72	2.34	55.73
Medical Assistant F	39.59	1.81	2.45	56.15
Medical Assistant G	46.41	2.17	2.98	48.43
Medical Assistant H	47.25	2.12	2.86	47.77
Medical Assistant (PEDS)	39.00	1.45	1.64	57.91
Medical Assistant (GYN)	16.12	1.92	2.04	79.91
MEDEVAC HM A	1.06	0.10	0.09	98.74

MEDEVAC HM B	59.76	0.85	0.49	38.89
MEDEVAC HM C	1.89	0.24	0.20	97.67
Triage Nurse A	38.83	1.15	1.30	58.72
Triage Nurse B	31.01	1.10	1.26	66.62
Triage Nurse C	14.20	0.56	0.52	84.72
Triage Nurse D	8.78	0.43	0.39	90.39
Department Head	27.65	1.02	0.67	70.67
Family Practice Physician	48.82	0.05	0.05	51.07
General Medical Officer A	45.34	0.51	0.48	53.66
General Medical Officer B	44.02	1.61	1.44	52.92
Physician Assistant	16.76	0.26	0.25	82.73
Nurse Practitioner A	15.75	0.26	0.24	83.75
Nurse Practitioner B	11.27	0.26	0.24	88.24
Independent Duty Corpsman	6.18	0.03	0.03	93.77
Health Promotions Nurse	6.75	0.07	0.01	93.16
USUHS Physician A	51.37	1.83	1.23	45.56
USUHS Physician B	29.75	0.96	0.56	68.73
Internists A	40.22	0.54	0.39	58.86
Internists B	21.17	0.21	0.13	78.49
Pediatrician	72.28	0.94	0.23	26.55
GYN Nurse Practitioner	30.24	0.85	0.27	68.65
Check-out Receptionist	11.86	- -	- -	88.14

Table 58

The Entity Activity of the MFHC Model.

Entity	AVG Minutes in System	AVG Minutes in Move Logic	AVG Minutes Waiting for Resource	AVG Minutes in Operation	AVG Minutes Blocked
PE Appointment	3.28	0.00	0.01	2.88	0.39
PE Patient	223.19	10.05	6.12	124.30	82.73
OM Preliminaries Patient	173.05	10.35	0.70	85.82	76.18
OM Consultation Patient	58.33	3.85	0.09	39.43	14.96
OM Certification Patient	59.55	3.88	4.47	20.00	31.20
OM PE Patient	67.70	4.89	0.03	37.38	25.40
OM "Walk-in" Patient	36.03	5.53	0.00	30.29	0.22
Routine Patient	149.63	3.41	2.57	59.55	84.10
"Walk-in" Patient	122.31	4.28	1.46	61.45	55.13
IM Patient	144.21	2.89	3.28	45.17	92.88
PEDS Patient	146.15	2.89	16.02	66.79	60.45
GYN Patient	136.70	4.46	12.35	56.08	63.80
"Needle-Stick" Patient	67.77	1.89	0.01	37.32	28.55
"Shots-Only" Patient	55.48	2.00	0.74	8.64	44.11
"Labs-Only" Patient	31.19	2.28	1.16	9.60	18.14

Table 59

The Entity Activity by Percentages of the MFHC Model.

Entity	% in Move Logic	% Wait for Resource	% In Operation	% Blocked
PE Appointment	0.00	0.17	88.84	10.99
PE Patient	4.59	2.76	56.42	36.23
OM Preliminaries Patient	6.37	0.29	51.41	41.93
OM Consultation Patient	6.83	0.17	69.70	23.30
OM Certification Patient	9.87	3.52	49.97	36.64
OM PE Patient	7.81	0.03	57.72	34.44
OM "Walk-in" Patient	19.50	0.00	80.12	0.38
Routine Patient	2.85	2.66	44.30	50.18
"Walk-in" Patient	3.97	1.39	52.92	41.73
IM Patient	2.42	2.75	35.38	59.45
PEDS Patient	2.31	12.03	47.10	38.55
GYN Patient	3.51	8.93	44.74	42.81
"Needle-Stick" Patient	3.66	0.02	71.10	25.22
"Shots-Only" Patient	4.70	1.37	19.87	74.06
"Labs-Only" Patient	9.29	4.18	38.17	48.37

Experiment 1: Using the Occupational Medicine Physician for Physical

Examinations Model

Table 60

Percentage Utilization of Physical Examinations (PE) and Occupational Medicine

(OM) Resources with Using the OM Physician for PEs.

Resource	Scheduled Hours	# of Times Used	Minutes Per Usage	% Utilization
Family Physician	3.12	4.70	33.07	81.27
Nurse Practitioner A	3.44	3.63	33.38	57.56
Nurse Practitioner B	3.40	2.92	32.34	45.17
PE Appointment Clerk A	7.00	11.41	2.91	7.77
PE Appointment Clerk B	8.00	11.80	2.96	7.13
Health Records Clerk A	7.00	8.52	0.62	1.24
Health Records Clerk B	8.00	8.01	0.62	1.02
Health Records Clerk C	7.00	8.47	0.62	1.24
PE Receptionist	8.00	17.46	4.74	17.72
PE Medical Assistant A	7.01	28.36	6.79	45.40
PE Medical Assistant B	12.25	31.40	8.47	35.82
PE Medical Assistant C	8.00	23.29	6.22	29.06
Laboratory Technician A	8.00	9.58	9.84	18.47
Laboratory Technician B	7.00	8.42	9.32	18.12
Immunizations Technician A	7.21	9.62	17.25	33.68
Immunizations Technician B	8.17	8.22	16.44	25.66
PE Office Clerk	8.04	13.39	5.53	13.82
OM Physician	7.65	5.55	38.91	39.12
Occupational Health (OH) Nurse	8.25	0.23	0.50	0.14
OH Technician A	7.30	9.39	10.11	10.67
OH Technician B	7.50	3.46	3.87	3.37
OM Receptionist	7.50	9.00	3.41	6.83
OM Medical Assistant	7.00	0.90	1.96	0.75

Table 61

States of Physical Examinations (PE) and Occupational Medicine (OM) Resources in

Experiment 1 by Percentage.

Resource	% In Use	% Travel to Use	% Travel to Park	% Idle
Family Physician	81.20	0.07	0.00	18.73
Nurse Practitioner A	57.42	0.14	0.01	42.43
Nurse Practitioner B	45.14	0.04	0.00	54.82
PE Appointment Clerk A	7.77	- -	- -	92.23
PE Appointment Clerk B	7.13	- -	- -	92.87
Health Records Clerk A	1.24	- -	- -	98.76
Health Records Clerk B	1.02	- -	- -	98.98
Health Records Clerk C	1.24	- -	- -	98.76
PE Receptionist	17.15	0.58	0.36	81.91
PE Medical Assistant A	42.93	2.47	2.15	52.46
PE Medical Assistant B	33.93	1.89	1.59	62.58
PE Medical Assistant C	27.06	2.01	1.56	69.38
Laboratory Technician A	18.29	0.18	0.18	81.36
Laboratory Technician B	17.94	0.18	0.18	81.70
Immunizations Technician A	33.68	0.00	0.18	66.14
Immunizations Technician B	25.65	0.01	0.13	74.21
PE Office Clerk	13.82	- -	- -	86.18
OM Physician	38.90	0.22	0.14	60.74
Occupational Health (OH) Nurse	0.11	0.03	0.02	99.84
OH Technician A	9.38	1.29	1.17	88.15
OH Technician B	2.85	0.52	0.46	96.16
OM Receptionist	6.83	- -	- -	93.17
OM Medical Assistant	0.59	0.16	0.11	99.14

Note. - - indicates no data.

Table 62

The Entity Activity of Experiment 1: Using the Occupational Medicine (OM)

Physician for Physical Examinations (PE).

Entity	AVG Minutes in System	AVG Minutes in Move Logic	AVG Minutes Waiting for Resource	AVG Minutes in Operation	AVG Minutes Blocked
PE Appointment	3.34	0.00	0.00	2.93	0.41
PE Patient	219.58	10.56	6.94	136.11	65.96
OM Preliminaries Patient	157.28	9.65	0.10	100.88	46.65
OM Consultation Patient	56.93	3.87	0.09	39.75	13.23
OM Certification Patient	32.34	3.54	6.48	19.96	2.36
OM PE Patient	71.91	4.89	3.47	38.93	24.61
OM "Walk-in" Patient	39.56	5.52	0.00	33.93	0.11

Table 63

The Entity Activity by Percentages of Experiment 1: Using the Occupational

Medicine (OM) Physician for Physical Examinations (PE).

Entity	% in Move Logic	% Wait for Resource	% in Operation	% Blocked
PE Appointment	0.00	0.15	88.87	10.99
PE Patient	4.91	3.19	62.56	29.35
OM Preliminaries Patient	6.42	0.06	65.30	28.21
OM Consultation Patient	6.99	0.17	71.78	21.05
OM Certification Patient	12.07	15.53	66.99	5.42
OM PE Patient	7.09	4.43	54.98	33.49
OM "Walk-in" Patient	19.09	0.00	80.64	0.28

Experiment 2: Combining Assets on the 2nd Floor Model

Table 64

Percentage Utilization of Physical Examinations (PE) and Occupational Medicine

(OM) Resources with Combining Assets on the 2nd Floor.

Resource	Scheduled Hours	# of Times Used	Minutes Per Usage	% Utiliz
Family Physician	3.13	4.79	32.94	
Nurse Practitioner A	3.43	3.67	34.15	
Nurse Practitioner B	3.40	3.13	32.21	
PE Appointment Clerk A	7.00	11.31	2.90	
PE Appointment Clerk B	8.00	11.94	2.98	
Health Records Clerk A	7.00	8.50	0.62	
Health Records Clerk B	8.00	8.00	0.62	
Health Records Clerk C	7.00	8.50	0.62	
PE Receptionist	8.00	14.14	4.68	
PE Medical Assistant A	7.01	26.80	6.48	
PE Medical Assistant B	12.25	27.39	9.30	
PE Medical Assistant C	8.00	19.94	6.24	
Laboratory Technician A	8.00	9.47	10.20	
Laboratory Technician B	7.00	8.52	9.05	
Immunizations Technician A	7.21	9.65	16.29	
Immunizations Technician B	8.02	8.17	14.47	
PE Office Clerk	8.03	13.90	5.41	
OM Physician	7.62	5.67	33.33	
Occupational Health (OH) Nurse	8.25	0.94	2.45	
OH Technician A	7.25	14.57	4.52	
OH Technician B	7.50	8.90	4.48	
OM Receptionist	7.50	9.00	3.41	
OM Medical Assistant	7.02	2.90	7.93	

Table 65

States of Physical Examinations (PE) and Occupational Medicine (OM) Resources in

Experiment 2 by Percentage.

Resource	% In Use	% Travel to Use	% Travel to Park	% Idle
Family Physician	82.07	0.07	0.00	17.85
Nurse Practitioner A	58.34	0.17	0.02	41.47
Nurse Practitioner B	48.63	0.05	0.00	51.32
PE Appointment Clerk A	7.65	--	--	92.35
PE Appointment Clerk B	7.24	--	--	92.76
Health Records Clerk A	1.24	--	--	98.76
Health Records Clerk B	1.02	--	--	98.98
Health Records Clerk C	1.23	--	--	98.77
PE Receptionist	13.72	0.41	0.28	85.59
PE Medical Assistant A	39.02	2.23	2.43	56.32
PE Medical Assistant B	32.33	1.52	1.67	64.48
PE Medical Assistant C	22.82	1.53	1.75	73.90
Laboratory Technician A	18.09	0.18	0.18	81.55
Laboratory Technician B	17.71	0.18	0.18	81.93
Immunizations Technician A	33.09	0.00	0.18	66.73
Immunizations Technician B	24.19	0.01	0.13	75.67
PE Office Clerk	14.50	--	--	85.50
OM Physician	38.78	0.22	0.15	60.85
Occupational Health (OH) Nurse	0.78	0.16	0.12	98.95
OH Technician A	14.70	2.82	2.16	80.32
OH Technician B	8.64	1.84	1.35	88.16
OM Receptionist	6.83	--	--	93.17
OM Medical Assistant	3.84	0.63	0.53	95.00

Note. -- indicates no data.

Table 66

The Entity Activity of Experiment 2: Combining Assets on the 2nd Floor.

Entity	AVG Minutes in System	AVG Minutes in Move Logic	AVG Minutes Waiting for Resource	AVG Minutes in Operation	AVG Minutes Blocked
PE Appointment	3.37	0.00	0.01	2.92	0.43
PE Patient	217.53	9.30	6.88	135.80	65.54
OM Preliminaries Patient	157.82	9.59	0.14	101.60	46.48
OM Consultation Patient	56.53	3.83	0.09	39.77	12.84
OM Certification Patient	34.72	3.51	7.95	20.68	2.57
OM PE Patient	70.06	4.89	3.33	38.39	23.44
OM "Walk-in" Patient	36.28	5.52	0.00	30.65	0.10

Table 67

The Entity Activity by Percentages of Experiment 2: Combining Assets on the 2nd

Floor.

Entity	% in Move Logic	% Wait for Resource	% in Operation	% Blocked
PE Appointment	0.00	0.21	87.86	11.93
PE Patient	4.39	3.19	63.41	29.01
OM Preliminaries Patient	6.40	0.08	65.74	27.77
OM Consultation Patient	6.95	0.17	72.13	20.75
OM Certification Patient	11.62	17.60	65.26	5.53
OM PE Patient	7.29	4.24	55.66	32.81
OM "Walk-in" Patient	19.70	0.00	79.94	0.36

Experiment 3: Moving Occupational Medicine Preliminaries to the Afternoon

Model

Table 68

Percentage Utilization of Physical Examinations (PE) and Occupational Medicine

(OM) Resources with Moving OM Preliminaries to the Afternoon.

Resource	Scheduled Hours	# of Times Used	Minutes Per Usage	% Utilization
Family Physician	3.17	4.86	33.18	83.04
Nurse Practitioner A	3.44	3.76	33.91	60.00
Nurse Practitioner B	3.40	3.16	32.52	49.08
PE Appointment Clerk A	7.00	11.13	2.94	7.65
PE Appointment Clerk B	8.00	12.02	2.89	7.11
Health Records Clerk A	7.00	8.85	0.62	1.30
Health Records Clerk B	8.00	7.40	0.62	0.94
Health Records Clerk C	7.00	8.75	0.62	1.27
PE Receptionist	8.00	14.39	4.63	14.15
PE Medical Assistant A	7.01	26.82	6.67	41.78
PE Medical Assistant B	12.25	27.47	9.25	33.83
PE Medical Assistant C	8.00	19.92	5.87	23.40
Laboratory Technician A	8.00	8.55	9.33	15.92
Laboratory Technician B	7.00	9.45	9.23	20.15
Immunizations Technician A	8.43	10.66	22.89	41.34
Immunizations Technician B	8.31	7.18	16.57	22.60
PE Office Clerk	8.03	14.08	5.57	14.70
OM Physician	7.63	6.16	34.33	42.56
Occupational Health (OH) Nurse	8.25	0.63	2.26	0.74
OH Technician A	7.25	15.73	4.63	19.38
OH Technician B	7.50	8.69	4.43	10.26
OM Receptionist	7.50	9.00	3.41	6.83
OM Medical Assistant	7.02	2.75	6.01	4.00

Table 69

States of Physical Examinations (PE) and Occupational Medicine (OM) Resources in

Experiment 3 by Percentage.

Resource	% In Use	% Travel to Use	% Travel to Park	% Idle
Family Physician	82.94	0.10	0.01	16.95
Nurse Practitioner A	59.81	0.19	0.01	39.99
Nurse Practitioner B	49.03	0.05	0.01	50.91
PE Appointment Clerk A	7.64	--	--	92.36
PE Appointment Clerk B	7.11	--	--	92.89
Health Records Clerk A	1.30	--	--	98.70
Health Records Clerk B	0.94	--	--	99.06
Health Records Clerk C	1.27	--	--	98.73
PE Receptionist	13.75	0.41	0.28	85.56
PE Medical Assistant A	39.51	2.27	2.46	55.76
PE Medical Assistant B	32.27	1.56	1.70	64.47
PE Medical Assistant C	21.92	1.48	1.79	74.81
Laboratory Technician A	15.77	0.16	0.16	83.92
Laboratory Technician B	19.97	0.18	0.18	79.66
Immunizations Technician A	41.34	0.00	0.18	58.48
Immunizations Technician B	22.60	0.00	0.11	77.28
PE Office Clerk	14.70	--	--	85.30
OM Physician	42.33	0.24	0.14	57.30
Occupational Health (OH) Nurse	0.61	0.12	0.09	99.17
OH Technician A	16.38	3.00	2.27	78.34
OH Technician B	8.44	1.83	1.34	88.40
OM Receptionist	6.83	--	--	93.17
OM Medical Assistant	3.37	0.63	0.49	95.51

Note. -- indicates no data.

Table 70

The Entity Activity of Experiment 3: Moving Occupational Medicine (OM)

Preliminaries to the Afternoon.

Entity	AVG Minutes in System	AVG Minutes in Move Logic	AVG Minutes Waiting for Resource	AVG Minutes in Operation	AVG Minutes Blocked
PE Appointment	3.26	0.00	0.01	2.91	0.35
PE Patient	217.78	9.25	7.50	140.74	60.29
OM Preliminaries Patient	77.08	8.42	3.12	63.60	1.94
OM Consultation Patient	53.06	4.31	0.09	39.83	8.82
OM Certification Patient	32.29	3.43	7.05	19.97	1.84
OM PE Patient	68.66	4.89	3.82	38.00	21.95
OM "Walk-in" Patient	39.04	5.53	0.00	33.38	0.14

Table 71

The Entity Activity by Percentages of Experiment 3: Moving Occupational Medicine

(OM) Preliminaries to the Afternoon.

Entity	% in Move Logic	% Wait for Resource	% in Operation	% Blocked
PE Appointment	0.00	0.16	90.00	9.84
PE Patient	4.35	3.48	65.36	26.80
OM Preliminaries Patient	11.24	3.82	82.46	2.48
OM Consultation Patient	8.33	0.19	77.35	14.13
OM Certification Patient	11.76	17.59	66.42	4.23
OM PE Patient	7.47	4.97	56.20	31.36
OM "Walk-in" Patient	19.05	0.00	80.50	0.45

Experiment 4: Moving Appointment Clerk to Medical Assistant Model

Table 72

Percentage Utilization of Physical Examinations (PE) and Occupational Medicine

(OM) Resources with Moving PE Appointment Clerk B to PE Medical Assistant D.

Resource	Scheduled Hours	# of Times Used	Minutes Per Usage	% Utilization
Family Physician	3.13	4.73	32.98	80.70
Nurse Practitioner A	3.41	3.81	33.76	61.45
Nurse Practitioner B	3.39	3.19	32.82	50.01
PE Appointment Clerk A	7.00	18.72	2.84	12.58
Health Records Clerk A	7.00	8.69	0.63	1.29
Health Records Clerk B	8.00	7.43	0.62	0.95
Health Records Clerk C	7.00	8.88	0.61	1.28
PE Receptionist	8.00	15.26	3.88	12.96
PE Medical Assistant A	7.00	26.08	6.77	41.78
PE Medical Assistant B	12.25	27.20	8.91	33.01
PE Medical Assistant C	8.00	18.77	6.13	22.77
PE Medical Assistant D	7.00	12.08	5.53	16.27
Laboratory Technician A	8.00	8.57	8.99	15.67
Laboratory Technician B	7.00	9.43	9.27	20.25
Immunizations Technician A	8.47	10.60	23.96	42.52
Immunizations Technician B	8.26	7.12	16.66	21.08
PE Office Clerk	8.03	14.19	5.15	14.75
OM Physician	7.60	6.31	33.63	43.06
Occupational Health (OH) Nurse	8.25	0.26	1.11	0.35
OH Technician A	7.30	12.93	10.10	15.07
OH Technician B	7.50	6.54	4.01	7.05
OM Receptionist	7.50	9.00	3.41	6.83
OM Medical Assistant	7.00	1.78	3.72	2.17

Table 73

States of Physical Examinations (PE) and Occupational Medicine (OM) Resources in

Experiment 4 by Percentage.

Resource	% In Use	% Travel to Use	% Travel to Park	% Idle
Family Physician	80.61	0.09	0.00	19.30
Nurse Practitioner A	61.26	0.19	0.02	38.53
Nurse Practitioner B	49.96	0.05	0.01	49.98
PE Appointment Clerk A	12.58	- -	- -	87.42
Health Records Clerk A	1.29	- -	- -	98.71
Health Records Clerk B	0.95	- -	- -	99.05
Health Records Clerk C	1.28	- -	- -	98.72
PE Receptionist	12.25	0.71	0.62	86.42
PE Medical Assistant A	39.61	2.17	2.55	55.67
PE Medical Assistant B	31.47	1.54	1.71	65.29
PE Medical Assistant C	21.45	1.31	1.65	75.58
PE Medical Assistant D	15.35	0.92	1.05	82.68
Laboratory Technician A	15.52	0.16	0.16	84.17
Laboratory Technician B	20.06	0.18	0.18	79.57
Immunizations Technician A	42.52	0.00	0.18	57.31
Immunizations Technician B	21.08	0.00	0.11	78.81
PE Office Clerk	14.75	- -	- -	85.25
OM Physician	42.81	0.25	0.15	56.80
Occupational Health (OH) Nurse	0.30	0.05	0.04	99.60
OH Technician A	12.88	2.18	1.69	83.25
OH Technician B	5.74	1.31	0.94	92.01
OM Receptionist	6.83	- -	- -	93.17
OM Medical Assistant	1.80	0.37	0.31	97.51

Note. - - indicates no data.

Table 74

The Entity Activity of Experiment 4: Moving Appointment Clerk to Medical

Assistant.

Entity	AVG Minutes in System	AVG Minutes in Move Logic	AVG Minutes Waiting for Resource	AVG Minutes in Operation	AVG Minutes Blocked
PE Appointment	3.41	0.00	0.12	2.88	0.41
PE Patient	212.04	8.89	7.37	137.71	58.07
OM Preliminaries Patient	76.87	8.38	2.77	63.59	2.14
OM Consultation Patient	52.84	4.30	0.09	39.72	8.72
OM Certification Patient	33.26	3.32	7.80	20.36	1.78
OM PE Patient	67.61	4.89	3.73	37.15	21.84
OM "Walk-in" Patient	39.52	5.53	0.00	33.86	0.13

Table 75

The Entity Activity by Percentages of Experiment 4: Moving Appointment Clerk to

Medical Assistant.

Entity	% in Move Logic	% Wait for Resource	% in Operation	% Blocked
PE Appointment	0.00	3.53	85.59	10.88
PE Patient	4.29	3.49	65.80	26.42
OM Preliminaries Patient	11.14	3.43	82.70	2.72
OM Consultation Patient	8.41	0.19	77.60	13.81
OM Certification Patient	11.37	18.64	66.32	3.67
OM PE Patient	7.54	4.70	55.92	31.84
OM "Walk-in" Patient	19.20	0.00	80.38	0.43

Experiment 5: Moving Occupational Medicine Medical Assistant to Physical

Examinations Model

Table 76

Percentage Utilization of Physical Examinations (PE) and Occupational Medicine

(OM) Resources with Moving OM Medical Assistant to PE Medical Assistant E.

Resource	Scheduled Hours	# of Times Used	Minutes Per Usage	% Utilization
Family Physician	3.13	4.85	33.09	83.59
Nurse Practitioner A	3.40	3.83	33.83	61.78
Nurse Practitioner B	3.40	3.33	32.49	51.69
PE Appointment Clerk A	7.00	18.36	2.84	12.39
Health Records Clerk A	7.00	8.79	1.29	1.29
Health Records Clerk B	8.00	7.38	0.62	0.94
Health Records Clerk C	7.00	8.83	0.62	1.28
PE Receptionist	8.00	13.18	3.42	9.95
PE Medical Assistant A	7.01	26.48	6.52	40.94
PE Medical Assistant B	12.25	26.78	9.23	32.99
PE Medical Assistant C	8.00	19.12	5.95	23.36
PE Medical Assistant D	7.00	11.73	5.89	16.52
PE Medical Assistant E	8.00	8.46	5.55	9.44
Laboratory Technician A	8.00	8.35	9.56	15.99
Laboratory Technician B	7.00	9.65	8.77	19.89
Immunizations Technician A	7.80	10.61	19.07	36.52
Immunizations Technician B	8.26	7.25	16.00	21.97
PE Office Clerk	8.04	14.50	5.25	14.96
OM Physician	7.60	6.26	33.39	43.11
Occupational Health (OH) Nurse	8.25	1.29	3.97	1.42
OH Technician A	7.27	10.89	7.08	11.94
OH Technician B	7.52	4.80	6.78	5.32
OM Receptionist	7.50	9.00	3.41	6.83
OM Medical Assistant	7.00	1.78	3.72	2.17

Table 77

States of Physical Examinations (PE) and Occupational Medicine (OM) Resources in

Experiment 5 by Percentage.

Resource	% In Use	% Travel to Use	% Travel to Park	% Idle
Family Physician	83.49	0.10	0.01	16.61
Nurse Practitioner A	61.58	0.20	0.02	38.20
Nurse Practitioner B	51.63	0.05	0.00	48.31
PE Appointment Clerk A	12.39	--	--	87.61
Health Records Clerk A	1.29	--	--	98.71
Health Records Clerk B	0.94	--	--	99.06
Health Records Clerk C	1.28	--	--	98.72
PE Receptionist	9.34	0.61	0.57	89.48
PE Medical Assistant A	38.73	2.21	2.58	56.48
PE Medical Assistant B	31.50	1.48	1.70	65.31
PE Medical Assistant C	22.04	1.32	1.73	74.91
PE Medical Assistant D	15.62	0.90	1.09	82.40
PE Medical Assistant E	8.90	0.54	0.75	89.81
Laboratory Technician A	15.83	0.16	0.16	83.86
Laboratory Technician B	19.70	0.19	0.19	79.93
Immunizations Technician A	36.52	0.00	0.19	63.29
Immunizations Technician B	21.96	0.00	0.11	77.92
PE Office Clerk	14.96	--	--	85.04
OM Physician	42.86	0.25	0.15	56.74
Occupational Health (OH) Nurse	1.21	0.22	0.19	98.39
OH Technician A	10.33	1.61	1.29	86.76
OH Technician B	4.46	0.86	0.69	93.99
OM Receptionist	6.83	--	--	93.17

Note. -- indicates no data.

Table 78

The Entity Activity of Experiment 5: Moving Occupational Medicine (OM) Medical

Assistant to Physical Examinations (PE).

Entity	AVG Minutes in System	AVG Minutes in Move Logic	AVG Minutes Waiting for Resource	AVG Minutes in Operation	AVG Minutes Blocked
PE Appointment	3.40	0.00	0.13	2.89	0.38
PE Patient	211.88	8.59	7.50	139.34	56.45
OM Preliminaries Patient	75.99	8.40	2.68	63.01	1.90
OM Consultation Patient	53.08	4.32	0.09	39.86	8.81
OM Certification Patient	35.04	3.41	9.29	20.09	2.25
OM PE Patient	70.73	4.89	3.70	38.04	24.10
OM "Walk-in" Patient	40.03	5.53	0.00	34.39	0.11

Table 79

The Entity Activity by Percentages of Experiment 5: Moving Occupational Medicine

(OM) Medical Assistant to Physical Examinations (PE).

Entity	% in Move Logic	% Wait for Resource	% in Operation	% Blocked
PE Appointment	0.00	3.73	85.82	10.45
PE Patient	4.13	3.58	66.32	25.96
OM Preliminaries Patient	11.30	3.44	82.82	2.44
OM Consultation Patient	8.41	0.19	77.55	13.86
OM Certification Patient	11.05	21.64	62.89	4.42
OM PE Patient	7.23	4.52	54.78	33.48
OM "Walk-in" Patient	18.88	0.00	80.74	0.37

The results of this project were made available to the management of the

family health center as a tool and will remain useful as long as maintained.

Discussion

Baselines

Tables 16 through 19 provided the researcher a baseline report of one year's

equivalent data of the physical examination process with current resources and

without competing processes. Tables 20 through 23 provided the same for the

occupational medicine patient visit. Table 16 indicates that utilization of resources

in the physical examination process ranged from less than a percent to 81 percent

(μ = 26.31, σ = 21.56, df = 2, and p = 0.51). Table 20 indicates that utilization of

resources in the occupational medicine patient visit ranged from less than a percent

to almost 39 percent (μ = 5.45 and σ = 10.01).

However, since the physical examination process and occupational

medicine patient visit share resources (health records clerks, laboratory technicians,

and immunizations technicians), the researcher decided to use the Physical

Examinations and Occupational Medicine Only Model for the baseline of 2nd Floor

activities (see Tables 24 through 27). Therefore, Table 24 indicates a more truer

utilization of resources and the baseline for Experiments 1 through 5. Table 24

indicates that utilization of resources on the 2nd Floor ranged from less than a

percent to almost 81 percent (μ = 21.99, σ = 20.10, df = 3, and p = 0.51).

The impact to utilization of resources by including the "labs only" patients to

the model are included in Tables 28 through 31. As expected the utilization on

average increased for the health records clerks from 1.16 (σ = 0.08) to 3.39 (σ =

0.17) percent and for the laboratory technicians from 18.22 (σ = 4.83) to 63.42 (σ

= 7.39) percent. Surprisingly to the researcher, the impact was less dramatic to the physical examinations process. The occupational medicine visit process was increased for the certification patient by approximately six minutes (32.44 to 38.64), the preliminaries patient by about five minutes (155.92 to 160.91), and the physical examination patient by approximately three minutes (60.84 to 63.92). However, the "walk-in" patient process was decreased by about one and one half minutes (40.34 to 38.99).

The impact to utilization of resources by including the "shots only" patients to the model are included in Tables 32 through 35. As expected the utilization on average increased for the health records clerks from 1.16 (σ = 0.08) to 2.23 (σ = 0.17) percent and for the immunizations technicians from 29.10 (σ = 10.30) to 52.38 (σ = 10.42) percent. The physical examinations process was increased by approximately five minutes (219.81 to 224.36). The occupational medicine visit process was increased for the Preliminaries patient by about 20 minutes (155.92 to 175.30), the certification patient by approximately 14 minutes (32.44 to 46.95), and the physical examination patient by approximately two minutes (60.84 to 62.90). Once again, the "walk-in" patient process was decreased, by about two minutes (40.34 to 38.45).

The impact to utilization of resources by including the "labs only" and "shots only" patients to the model are included in Tables 36 through 39. As expected the utilization on average increased for the health records clerks from 1.16 (σ = 0.08) to 4.43 (σ = 0.35) percent, for the laboratory technicians from 18.22 (σ = 4.83) to

62.83 (σ = 8.40) percent, and for the immunizations technicians from 29.10 (σ = 10.30) to 53.51 (σ = 11.32) percent. The physical examinations process was increased by approximately one minute (219.81 to 220.98). The occupational medicine visit process was increased for the preliminaries patient by about 25 minutes (155.92 to 181.26), the certification patient by approximately 19 minutes (32.44 to 51.55), the physical examination patient by about six minutes (60.84 to 66.64), and the consultation patient by approximately three minutes (55.28 to 58.96). Once again, the "walk-in" patient process was decreased, by about two minutes (40.34 to 38.45).

Tables 40 through 43 provided the researcher a baseline report of one year's equivalent data of the general primary care visit on the 1st Floor with current resources and without competing processes. Tables 44 through 47 provided the same for the internist patient visit, Tables 48 through 51 provided the same for the visit to the pediatrician, and Tables 52 through 55 provided the same for the Women's Health Needs Visit. Table 40 indicates that utilization of resources in the general primary care visit on the 1st Floor with current resources and without competing processes ranged from less than a percent to almost 72 percent (μ = 25.31, σ = 19.89, df = 4, and p = 0.02). Table 44 indicates that utilization of resources in the internal medicine patient visit ranged from less than a percent to 59 percent (μ = 19.64, σ = 18.90, df = 2, and p = 0.07). Table 48 indicates that utilization of resources in the pediatrician patient visit ranged from less than a percent to 91 percent (μ = 18.17, σ = 22.05, df = 2, and p = 0.66). Table 52

indicates that utilization of resources in the women's health needs visit ranged from less than a percent to 81 percent ($\mu = 10.00$, $\sigma = 19.48$, df = 2, and p = 0.33).

Tables 56 through 59 provided the researcher a baseline report of one year's equivalent data of patients being seen by the entire MFHC with current resources and with all the competing processes of the 1st and 2nd Floors. Table 56 indicates that overall, utilization of resources in the MFHC ranged from less than a percent to 80 percent ($\mu = 29.88$, $\sigma = 20.11$, df = 4, and p = 0.10). The utilization of the providers in the MFHC ranged from six percent to 80 percent ($\mu = 37.66$, $\sigma = 19.10$, df = 2, and p = 0.69). The utilization of the support staff in the MFHC ranged from six percent to 65 percent ($\mu = 26.28$, $\sigma = 19.54$, df = 4, and p = 0.17).

Experiments

Tables 60 through 63 summarize the impact of utilizing the occupational medicine physician for the physical examinations process. The utilization on average only increased from 38.17 ($\sigma = 11.58$) to 39.12 ($\sigma = 16.72$) percent. However, the occupational medicine visit process was increased for the physical examination patient by about 11 minutes (60.84 to 71.91), the preliminaries patient by approximately one and one half minutes (155.92 to 157.28), and consultation patient by about one and one half minutes (55.28 to 56.93). The occupational medicine physician remained idle on average for about 60.74 percent of the time.

Tables 64 through 67 summarize the impact of combining assets on the 2nd

Floor. The utilization on average decreased for the physical examination

receptionist from 18.33 (σ = 3.68) to 14.12 (σ = 3.38) percent and for the physical

examination medical assistants from 35.65 (σ = 5.32) to 32.97 (σ = 5.22).

However, the utilization on average increased for the occupational health nurse

from 0.11 (σ = 0.41) to 0.94 (σ = 1.22) percent, for the occupational health

technicians from 7.61 (σ = 1.44) to 13.95 (σ = 2.43), and for the occupational

medicine medical assistant from 0.67 (σ = 0.95) to 4.47 (σ = 6.10). There was a

decrease in the physical examination process by approximately two minutes

(219.81 to 217.53) and the occupational medicine visit process for the "walk-in"

patient by about four minutes (40.34 to 36.28). The occupational medicine patient

visit process was increased for the physical examination patient by about 11

minutes (60.84 to 70.06), for the preliminaries patient by approximately two

minutes (155.92 to 157.82), for the certification patient by about two minutes

(32.44 to 44.72), and for the consultation patient by approximately one minute

(55.28 to 56.53).

Tables 68 through 71 summarize the impact of moving occupational

medicine preliminaries to the afternoon schedule. The utilization on average

decreased for the physical examination receptionist from 18.33 (σ = 3.68) to 14.15

(σ = 3.13) percent and for the physical examination medical assistants from 35.65

(σ = 5.32) to 32.83 (σ = 5.34). However, the utilization on average increased for

the occupational health nurse from 0.11 (σ = 0.41) to 0.74 (σ = 1.16) percent, for

the occupational health technicians from 7.61 (σ = 1.44) to 14.75 (σ = 2.69), and

for the occupational medicine medical assistant from 0.67 (σ = 0.95) to 4.00 (σ =

6.13). There was a decrease in the physical examination process by approximately

two minutes (219.81 to 217.78), but more importantly, a decrease in the

occupational medicine patient visit process for the preliminaries patient by almost

79 minutes (155.92 to 77.08), for the physical examination patient by about 11

minutes (60.84 to 70.06), for the certification patient by about two minutes (32.44

to 44.72), and for the consultation patient by approximately one minute (55.28 to

56.53).

Tables 72 through 75 summarize the impact of reducing appointment clerks

from two to one and increasing medical assistants from three to four in the physical

examinations process. The utilization on average increased for the appointment

clerk from 7.60 (σ = 1.45) to 12.58 (σ = 2.41) percent and decreased for the

physical examination medical assistants from 35.65 (σ = 5.32) to 28.99 (σ = 4.26).

There was a decrease in the physical examination process by almost eight minutes

(219.81 to 212.04) and a negligible increase in physical examination appointment

time (from 3.35 to 3.41 minutes).

Tables 76 through 79 summarize the impact of moving the occupational

medicine medical assistant to physical examinations, thereby, increasing medical

assistants from four to five medical assistants in the physical examinations process.

The utilization on average increased for the occupational health nurse from 0.35 (σ

= 0.96) to 1.42 (σ = 1.76) percent, but decreased for the occupational health

technicians from 11.09 (σ = 5.41) to 8.67 (σ = 5.38) and physical examination

medical assistants from 28.99 (σ = 4.26) to 25.31 (σ = 3.40). There was a slight

decrease in the physical examination process by less than a minute (212.04 to

211.88) and occupational medicine preliminaries patient visit time by less than a

minute (3.35 to 3.41). However, the occupational medicine visit increased for

physical examination patient by about two minutes (67.61 to 70.73), for the

certification patient by almost two minutes (33.26 to 35.04), for the "walk-in"

patient by less than a minute (39.52 to 40.03), and for the consultation patient by

less than a minute (52.54 to 53.08).

Conclusions and Recommendations

The last step in the simulation procedure is to make recommendations for

improvement in the actual system or hypothetical system based on the results of the

simulated model. A decision to do a simulation project resulted from a perception

that simulation would validate and offer an objective evaluation of the staffing plans

and potentially, optimize staffing options.

The researcher therefore recommends moving occupational medicine

preliminaries to the afternoon schedule. This decreases the time of the physical

examination process by approximately two minutes, but more importantly, it also

decreases the occupational medicine patient visit process for the preliminaries

patient by almost 79 minutes, for the physical examination patient by about 11

minutes, for the certification patient by about two minutes, and for the consultation

patient by approximately one minute.

The researcher also recommends reducing appointment clerks from two to one and increasing medical assistants from three to four in the physical examinations process. This action will decrease the physical examination process by almost eight minutes.

The researcher further recommends using the EBC PLANNER to assess resource requirements once an exact beneficiary population is defined. Historically, healthcare staffing has been defined by the Joint Healthcare Manpower Standards. These standards are workload based standards and obsolete in the resource-based capitated system of today.

Peripheral Observations and Follow-on Study Opportunities

Tables 18 and 19 in the Physical Examinations Only Model identified that the physical examination patient is blocked on average almost 65 minutes or 30 percent during the process. The baseline model reported that an average of 13.95 of 16 patients actually completed the physical examination process under the current constraints. Table 80 identifies those locations that are full (multiple capacity) or blocked (single capacity) by percentage. Additionally, Tables 22 and 23 in the Occupational Medicine Only Model identified that the occupational medicine physical examination patient is also blocked on average almost 18 minutes or 28 percent during the process. A study of the effects of having the physical examination patients arriving earlier or increasing the availability of exam rooms is warranted.

Table 80

States of Physical Examination Locations by Percentage.

Location	Capacity	% Empty (Idle)	% Partially Occupied	% Full (Blocked)	% Utilization
PE Reception	3	95.51	2.95	1.55	2.95
Laboratory	2	89.28	4.13	6.59	8.66
PE Visual Acuity Station	2	63.84	21.18	14.98	25.57
PE Hearing Test Station	2	82.95	11.36	5.69	11.37
PE EKG Station	2	91.32	6.68	2.00	5.34
PE Vital Signs Station	1	73.67	- -	19.80	19.80
Immunizations	1	72.38	- -	18.59	18.59
PE Exam Room 1	1	20.20	- -	79.80	79.80
PE Exam Room 2	1	40.92	- -	59.08	59.08
PE Exam Room 3	1	50.58	- -	49.42	49.42
PE Exam Room 4	1	63.23	- -	30.22	30.22
PE Exam Room 5	1	57.96	- -	42.04	42.04

Note. - - indicates no data available.

In addition to the location constraints on the physical examination process,

Table 81 identifies some location constraints that affect the primary care visit.

Table 81

States of Primary Care Visit Locations by Percentage.

Location	Capacity	% Empty (Idle)	% Partially Occupied	% Full (Blocked)	% Utilization
FHC Reception	2	31.05	9.98	58.97	63.96
FHC Waiting Room	13	15.64	42.60	41.77	61.52
Adult TX Room	2	68.48	18.94	12.58	22.05
PEDS "Well-Baby" Waiting Room	4	48.90	46.37	4.74	23.19
PEDS "Sick-Baby" Waiting Room	5	29.31	46.95	23.74	45.06
GYN Waiting Room	4	91.04	8.45	0.51	3.88
FHC Vital Signs Station 1	1	26.85	- -	58.71	73.15
FHC Vital Signs Station 2	1	32.40	- -	56.08	67.60
Triage	1	60.86	- -	26.27	39.14
PEDS Vital Signs Station	1	84.26	- -	11.87	15.74

Note. - - indicates data not available.

Based on the information contained in Table 81, the researcher further recommends increasing the capacity of the waiting rooms and equipping exam rooms with the ability to have vital signs taken in them. This would possibly increase the opportunity for triage to be conducted additionally in the regular vital signs stations.

The Pediatrics Only Model identified a major concern to the researcher. The current pediatrician at the MFHC examines a total of 15 patients on her most productive day. Future workload indicates that a total of 40 pediatric patients will require to be examined daily. Certainly pediatric patients can be examined by family physicians, general practitioners, physician assistants, and nurse practitioners. However, most of these providers have been working in an environment where the patient has been a predominantly healthy active duty member. This researcher recommends that further analysis be conducted towards adding an additional pediatrician in exchange for one of the current providers.

The Women's Health Needs Only Model identified another concern to the researcher. The current gynecology nurse practitioner at the MFHC examines a total of 12 patients per week. Future workload indicates that a total of 13 visits will be required for breast exams and Pap smears daily. Women's health can be more than adequately performed by the current family physicians, general practitioners, physician assistant, and nurse practitioners. However, from a production point of view, this researcher recommends that further analysis be conducted towards adding the gynecology nurse practitioner full-time to ensure that women's health needs are adequately addressed.

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Appendix A
Average Physical Examinations (PEs) per Day

MONTH	1995			1996			1997		
	# of PEs	# of Workdays	AVG PEs per Day	# of PEs	# of Workdays	AVG PEs per Day	# of PEs	# of Workdays	AVG PEs per Day
JAN	120	18	6.67	184	19	9.68	199	19	10.47
FEB	184	17	10.82	290	18	16.11	270	17	15.88
MAR	222	21	10.57	301	19	15.84	218	19	11.47
APR	216	18	12.00	223	20	11.15	274	20	13.70
MAY	275	20	13.75	126	19	6.63	215	18	11.94
JUN	295	19	15.53	156	18	8.67	218	19	11.47
JUL	331	18	18.39	206	20	10.30	170	20	8.50
AUG	321	21	15.29	270	20	13.50	201	19	10.58
SEP	244	18	13.56	291	18	16.17	217	19	11.42
OCT	286	19	15.05	286	19	15.05	225	19	11.84
NOV	210	18	11.67	233	18	12.94	174	17	10.24
DEC	125	18	6.94	151	19	7.95	129	21	6.14
TOTAL	2,829	225	12.57	2,717	227	11.97	2,510	227	11.06

Appendix B
Average Patient (PT) Visits per Day

Appendix B

MONTH	1995			1996			1997		
	# of PTs	# of Workdays	AVG PTs per Day	# of PTs	# of Workdays	AVG PTs per Day	# of PTs	# of Workdays	AVG PTs per Day
JAN	1,230	20	61.50	963	21	45.86	885	21	42.14
FEB	1,250	19	65.79	1,090	20	54.50	1,030	19	54.21
MAR	1,524	23	66.26	1,256	21	59.81	911	21	43.38
APR	1,261	20	63.05	1,386	22	63.00	931	22	42.32
MAY	1,331	22	60.50	1,152	22	52.36	963	21	45.86
JUN	1,394	22	63.36	1,093	20	54.65	784	21	37.33
JUL	1,114	20	55.70	1,110	22	50.45	833	22	37.86
AUG	1,414	23	61.48	1,060	22	48.18	694	21	33.05
SEP	1,226	20	61.30	1,002	20	50.10	877	21	41.76
OCT	1,431	21	68.14	1,053	22	47.86	918	22	41.73
NOV	1,073	20	53.65	872	19	45.89	796	18	44.22
DEC	1,035	20	51.75	823	21	39.19	978	22	44.45
TOTAL	15,283	250	61.13	12,860	252	51.03	10,600	251	42.23

Note. These numbers do not reflect the patient visits for physical examinations.

Appendix C
Average Walk-ins per Day

MONTH	1995			1996			1997		
	# of Walk-in Visits	# of Workdays	AVG Walk-ins per Day	# of Walk-ins	# of Workdays	AVG Walk-ins per Day	# of Walk-ins	# of Workdays	AVG Walk-ins per Day
JAN		20	0.00	3	21	0.14	188	21	8.95
FEB	2	19	0.11	7	20	0.35	188	19	9.89
MAR	2	23	0.09	6	21	0.29	167	21	7.95
APR	3	20	0.15	252	22	11.45	333	22	15.14
MAY	4	22	0.18	470	22	21.36	417	21	19.86
JUN	102	22	4.64	384	20	19.20	342	21	16.29
JUL	19	20	0.95	503	22	22.86	351	22	15.95
AUG	17	23	0.74	223	22	10.14	308	21	14.67
SEP	23	20	1.15	238	20	11.90	395	21	18.81
OCT	9	21	0.43	238	22	10.82	488	22	22.18
NOV	19	20	0.95	170	19	8.95	342	18	19.00
DEC	5	20	0.25	266	21	12.67	142	22	6.45
TOTAL	205	250	0.82	2,760	252	10.95	3,661	251	14.59

Appendix D
Average Follow-up (F/U) Patients Seen per Day

MONTH	1995			1996			1997		
	# of F/Us	# of Workdays	AVG F/Us per Day	# of F/Us	# of Workdays	AVG F/Us per Day	# of F/Us	# of Workdays	AVG F/Us per Day
JAN	57	20	2.85	4	21	0.19	168	21	8.00
FEB	37	19	1.95	36	20	1.80	193	19	10.16
MAR	1	23	0.04	8	21	0.38	183	21	8.71
APR	2	20	0.10	4	22	0.18	131	22	5.95
MAY	7	22	0.32	0	22	0.00	113	21	5.38
JUN	21	22	0.95	0	20	0.00	75	21	3.57
JUL	40	20	2.00	0	22	0.00	71	22	3.23
AUG	28	23	1.22	200	22	9.09	73	21	3.48
SEP	12	20	0.60	185	20	9.25	96	21	4.57
OCT	6	21	0.29	189	22	8.59	74	22	3.36
NOV	31	20	1.55	155	19	8.16	59	18	3.28
DEC	28	20	1.40	110	21	5.24	47	22	2.14
TOTAL	270	250	1.08	891	252	3.54	1,283	251	5.11

Occupational Medicine's Workload (Average Number of Patient (PT) Examinations per Day)

Month	# of PT Exams	# of Workdays	AVG # of PT Exams per Day
Mar-96	100	21	4.76
Apr-96	123	22	5.59
May-96	135	22	6.14
Jun-96	179	20	8.95
Jul-96	105	22	4.77
Aug-96	111	22	5.05
Sep-96	85	20	4.25
Oct-96	60	22	2.73
Nov-96	94	19	4.95
Dec-96	41	21	1.95
Jan-97	95	21	4.52
Feb-97	81	19	4.26
Mar-97	84	21	4.00
Apr-97	102	22	4.64
May-97	54	21	2.57
Jun-97	160	21	7.62
Jul-97	96	22	4.36
Aug-97	95	21	4.52
Sep-97	78	21	3.71
Oct-97	119	22	5.41
Nov-97	106	18	5.89
Dec-97	48	22	2.18
Jan-98	89	20	4.45
Feb-98	80	19	4.21
Total	2,320	501	4.63

Occupational Medicine's Workload (Average Number of Physical Examinations (PEs) per Day

Month	# of PEs	# of Workdays	AVG # of PEs per Day
Mar-96	43	21	2.05
Apr-96	61	22	2.77
May-96	82	22	3.73
Jun-96	138	20	6.90
Jul-96	54	22	2.45
Aug-96	74	22	3.36
Sep-96	57	20	2.85
Oct-96	99	22	4.50
Nov-96	89	19	4.68
Dec-96	81	21	3.86
Jan-97	57	21	2.71
Feb-97	36	19	1.89
Mar-97	50	21	2.38
Apr-97	48	22	2.18
May-97	78	21	3.71
Jun-97	109	21	5.19
Jul-97	47	22	2.14
Aug-97	57	21	2.71
Sep-97	41	21	1.95
Oct-97	83	22	3.77
Nov-97	58	18	3.22
Dec-97	24	22	1.09
Jan-98	70	20	3.50
Feb-98	62	19	3.26
Total	1,598	501	3.19

Occupational Medicine's Workload (Average Number of Walk-ins per Day)

Month	# of Walk-ins	# of Workdays	AVG # of Walk-ins per Day
Jan-97	28	21	1.33
Feb-97	26	19	1.37
Mar-97	--		
Apr-97	39	22	1.77
May-97	17	21	0.81
Jun-97	25	21	1.19
Jul-97	35	22	1.59
Aug-97	21	21	1.00
Sep-97	26	21	1.24
Oct-97	30	22	1.36
Nov-97	23	18	1.28
Dec-97	12	22	0.55
Jan-98	10	20	0.50
Feb-98	18	19	0.95
Total	310	269	1.15

Note. -- indicates that data was unavailable for March 1997.

Occupational Medicine's Workload (Number of Follow-ups (F/Us) and Number of Patient (PT) Visits

Month	# of F/Us	# of PT Visits
Jan-97	0	172
Feb-97	1	128
Mar-97	--	
Apr-97	0	170
May-97	1	132
Jun-97	0	249
Jul-97	0	177
Aug-97	0	171
Sep-97	1	130
Oct-97	2	174
Nov-97	5	127
Dec-97	8	70
Jan-98	2	159
Feb-98	6	166
Total	26	2,025

Note. – indicates that data was unavailable for March 1997.

Duration and Frequency of Patient Transports

Duration of Departure (Minutes)	Frequency (# of Runs)
24	1
25	2
27	1
29	1
30	3
34	1
35	4
37	1
38	1
40	8
41	1
42	1
44	1
45	21
46	2
48	2
50	32
51	1
52	8
53	3
54	4
55	17
56	1
57	4
58	3
59	3
60	23
61	3
62	1
63	1
64	1
65	18
66	1
68	1
69	2
70	11
71	2
75	7
77	2
80	6
82	1
84	1
85	9
87	1
90	13
95	8
100	2
104	1

Duration and Frequency of Patient Transports

Duration of Departure (Minutes)	Frequency (# of Runs)
105	11
106	1
110	10
111	2
114	1
115	9
120	6
121	1
125	8
126	1
130	4
132	1
133	1
135	6
136	1
140	8
142	1
143	1
145	8
150	4
151	1
152	1
155	6
160	4
161	2
165	3
172	1
180	3
187	1
190	2
195	1
200	3
207	1
210	3
212	1
225	1
235	1
236	1
245	1
250	1
260	1
268	1
270	1
280	1
285	1
290	2
300	1
330	1

Duration and Frequency of Patient Transports

Duration of Departure (Minutes)	Frequency (# of Runs)
335	1
340	1
345	1
420	1
536	1

Time of Departure and Frequency of Patient Transports

Time of Departure (Hour)	Frequency (# of Runs)
0006	1
0010	2
0023	1
0025	2
0030	2
0033	1
0045	1
0050	1
0100	1
0110	1
0115	1
0122	1
0124	1
0130	2
0140	1
0147	1
0150	3
0200	2
0205	1
0210	3
0230	2
0255	1
0300	1
0310	1
0324	1
0330	2
0340	2
0410	2
0415	1
0425	1
0430	3
0440	1
0500	2
0510	1
0515	3
0516	1
0529	1
0530	1
0545	1
0555	1
0615	1
0630	2
0640	1
0645	1
0655	1
0700	1
0710	1
0715	1

Time of Departure and Frequency of Patient Transports

Time of Departure (Hour)	Frequency (# of Runs)
0730	1
0745	1
0800	1
0805	1
0810	1
0815	1
0840	2
0845	2
0900	2
0910	1
0915	2
0916	1
0920	1
0922	1
0930	2
0936	1
0946	1
1000	1
1004	1
1005	1
1010	3
1015	3
1020	1
1025	2
1030	7
1034	1
1040	1
1053	1
1058	1
1100	1
1105	2
1108	1
1110	3
1120	1
1125	1
1129	1
1130	1
1140	1
1145	5
1150	2
1200	6
1205	1
1210	2
1215	2
1225	2
1230	4
1235	1
1240	2

Time of Departure and Frequency of Patient Transports

Time of Departure (Hour)	Frequency (# of Runs)
1245	2
1250	1
1300	3
1305	2
1310	2
1312	1
1315	3
1320	2
1321	1
1330	3
1343	1
1345	1
1350	1
1355	2
1359	1
1400	5
1405	1
1406	1
1410	3
1415	2
1420	3
1422	1
1430	2
1435	1
1440	1
1443	1
1445	1
1450	3
1500	5
1505	2
1508	1
1510	4
1515	3
1520	1
1525	2
1530	3
1545	3
1550	2
1555	1
1600	3
1605	1
1610	4
1613	1
1615	1
1620	1
1630	4
1635	1
1640	2

Time of Departure and Frequency of Patient Transports

Time of Departure (Hour)	Frequency (# of Runs)
1645	3
1650	1
1700	7
1710	2
1720	1
1725	2
1730	11
1735	1
1740	4
1745	1
1750	1
1752	1
1800	3
1805	3
1810	1
1815	2
1819	1
1828	1
1830	4
1835	1
1845	4
1850	2
1855	1
1900	1
1905	2
1910	1
1930	3
1934	1
1935	2
1940	1
1944	1
1945	1
1950	1
1958	1
1959	1
2000	2
2010	4
2015	1
2020	1
2030	5
2035	1
2040	1
2045	1
2050	2
2100	1
2110	2
2115	1
2130	4

Time of Departure and Frequency of Patient Transports

Time of Departure (Hour)	Frequency (# of Runs)
2140	1
2145	2
2153	1
2200	2
2210	1
2215	1
2220	2
2235	2
2245	2
2250	1
2253	1
2300	1
2320	3
2325	1
2330	5
2332	1
2335	1
2345	2
2350	1
2400	1

Time of Departure and Duration of Aeromedical Evacuation Patient Transports

Date	Time of Departure (Hour)	Duration (Minutes)
5-Mar-98	0550	85
	1709	150
6-Mar-98	0620	188
	1400	132
	1715	95
7-Mar-98	0630	120
	1030	150
	1715	250
9-Mar-98	1100	212
11-Mar-98	1912	66
12-Mar-98	0600	150
	1715	160
13-Mar-98	1415	120
14-Mar-98	0632	88
	--	--
15-Mar-98	1650	220
16-Mar-98	1130	345
18-Mar-98	1700	140
19-Mar-98	0605	228
	1545	135
20-Mar-98	0610	110
	1430	120
21-Mar-98	0612	333
	1200	135
22-Mar-98	1545	85
23-Mar-98	1345	89
	1522	--
	--	--
24-Mar-98	1050	111
	1330	230
25-Mar-98	1700	190
26-Mar-98	0615	155
	1525	160
27-Mar-98	0611	164
	1515	274
28-Mar-98	0600	90
	1115	100
	1720	110
29-Mar-98	1345	137
	1730	183
30-Mar-98	1030	195
	2229	71

Note. -- indicates data unavailable or illegible.

Time of Departure and Frequency of Aeromedical Evacuation Patient Transports

Time of Departure (Hour)	Frequency (# of Runs)
0550	1
0600	2
0605	1
0610	1
0611	1
0612	1
0615	1
0620	1
0630	1
0632	1
1030	2
1050	1
1100	1
1115	1
1130	1
1200	1
1330	1
1345	2
1400	1
1415	1
1430	1
1515	1
1522	1
1525	1
1545	2
1650	1
1700	2
1709	1
1715	3
1720	1
1730	1
1912	1
2229	1

Appendix M
Descriptive Statistics of Physical Examination Processes

Process	Mean (Minutes)	s (Minutes)	n	Fitted Distribution
Use of PE Booking HM (Appointment)	2.85	2.09	10	Weibull (0, 1.36, 3.11)
Use of Records HM (Pulling Health Record)	0.61	0.21	10	Pearson 5 (0, 9.16, 4.99)
Use of Reception HM (Check-in & Instructions)	2.92	1.42	16	Log-Logistic (0, 3.32, 2.62)
Use of Laboratory Tech (Specimens Drawn)	8.11	4.19	16	Log-Logistic (2, 2.29, 4.83)
Completing paperwork (Patient Only)	26.46	9.36	10	Weibull (12, 1.4, 15.7)
Use of PE HM (EKG)	8.43	1.85	13	Gamma (5, 2.8, 1.22)
Use of PE HM (Vital Signs)	3.11	2.59	16	Pearson 5 (1, 2.22, 2.51)
Use of PE HM (Hearing Test)	7.46	1.63	15	Log-Logistic (5, 2.36, 2.06)
Use of PE HM (Sight Test)	7.95	3.19	13	Log-Logistic (0, 4.63, 7.24)
Use of Immunizations Tech (Administrative)	3.71	1.36	18	Erlang (1, 3, 0.905)*
Use of Immunizations Tech (Shots given)	3.28	2.07	18	Lognormal (1, 0.273, 1.2)
Use of Provider (PE)	32.67	12.21	13	Weibull (16, 1.32, 18)
Use of PE Office HM or PE HM (Check-out)	4.03	4.45	10	Pearson 6 (0, 0.0875, 23.9, 1.32)

Note. Log-Logistic (1, 2.9, 2.44) was used for Fitted Distribution for Use of Immunizations Tech (Administrative) instead of Erlang (1, 3, 0.905). MedModel has a programming error processing Erlang Distributions.

Appendix N
Descriptive Statistics of Sick Call and Internist Visit Processes

Process	Mean (Minutes)	s (Minutes)	n	Fitted Distribution
Travel from Health Records (2nd Floor) to MFHC Entrance (1st Floor)	1.63	0.5	10	Pearson 5 (0, 13.1, 19.7)
Use of Reception HM-Appointment (Check-in)	3.41	2.91	16	Pearson 5 (0, 2.28, 4.52)
Use of Reception HM-"Walk-in" (Check-in)	5.85	5.62	10	Inverse Gaussian (0, 4.37, 5.86)
Use of Triage RN-"Walk-in" (Triage)	6.29	2.55	8	--
Use of HM (Vital Signs)	3.23	1.42	28	Pearson 6 (1, 0.72, 13.1, 5.24)
Use of Doctor (Exam)	17.3	7.51	11	Log-Logistic (4, 1.55, 11.4)
Use of Physician Assistant (Exam)	15.1	9.13	13	Log-Logistic (1, 1.88, 11.6)
Use of Nurse Practitioner (Exam)	16.31	8.85	11	Triangular (4, 38, 4)
Use of Independent Duty Corpsman (Exam)	11.35	6.39	12	Weibull (1, 1.33, 11.1)
Use of HM (Room Preparation)	0.74	0.45	4	--
Use of HM (Restocking Room)	5.58	--		--
Use of HM (Treatments)	40.43	57.53	5	--
Use of HM (Treatment Room Preparation)	4.85	1.74	3	--
Use of Reception HM (Schedule Follow-up)	3.71	0.95	4	--
Use of Internist (Exam)	25.34	10.52	11	Weibull (12, 1.11, 13.8)

Note.-- indicates insufficient data to perform tests.

Appendix O
Descriptive Statistics of Pediatrician and Gynecology Nurse Practitioner Visit Processes

Process	Mean (Minutes)	s (Minutes)	n	Fitted Distribution
Use of HM-Patient Less than 90 Centimeters (Vital Signs)	9.40	2.19	18	Uniform (6, 13.1)
Use of HM-Patient 90 Centimeters or Greater (Vital Signs)	4.42	0.99	10	Weibull (2, 2.67, 2.72)
Use of Pediatrician (Exam)	29.82	20.17	15	Log-Logistic (9, 2.03, 15)
Use of Gynecology Nurse Practitioner (Pre-Exam History)	9.00	6.89	17	Exponential (3, 6)
Use of Restroom (Patient Only)	1.53	0.53	10	Log-Logistic (0, 5.23, 1.43)
Use of HM (Patient Instructions)	0.72	0.34	13	Weibull (0, 2.26, 0.82)
Patient Changing (Pre-Exam)	4.86	3.79	18	Pearson 5 (1, 1.81, 3.48)
Use of Gynecology Nurse Practitioner & HM (Exam)	9.88	3.69	22	Log-Logistic (0, 5.63, 9.11)
Patient Changing (Post-Exam)	4.04	1.73	20	Weibull (0, 2.35, 4.5)
Use of Gynecology Nurse Practitioner (Post-Exam Consultation)	6.07	5.71	15	Gamma (0, 1.32, 4.59)
Use of HM (Room Preparation)	2.03	0.74	15	Weibull (0, 3.02, 2.28)

Appendix P

Providers	7:40 AM	8:00 AM	8:20 AM	8:30 AM	8:40 AM	9:00 AM	9:20 AM	9:30 AM	9:40 AM	10:00 AM	10:20 AM	10:30 AM	10:40 AM
							EXAM TIMES						
Family Physician (DEPT HD)	SDA	SDA	ROU		ROU	ROU	ROU		ROU	ROU	ROU		ROU
Family Physician		SDA	SDA					PE	PE	PE		PE	
Internist A				ROU	ROU	ROU	ROU	ROU	ROU	ROU	ROU	ROU	
Internist B													
Pediatrician						URG	URG		URG	URG	URG		URG
General Medical Officer A						**FLOAT PROVIDER**							
General Medical Officer B	SDA	SDA	ROU	PE		PE	PE	PE	PE	PE	PE	PE	
USUHS Physician A	SDA	SDA	ROU		SDA	ROU	SDA		ROU	SDA	ROU		SDA
USUHS Physician B		SDA	SDA		ROU	ROU	ROU			ROU	ROU		ROU
Occupational Medicine Physician			CONS		CONS	CONS		CONS		F/U	CERT		CERT
Physician Assistant													
Nurse Practitioner A	SDA	SDA	ROU	PE		PE	PE	PE		PE		PE	
Nurse Practitioner B	SDA	SDA	ROU	PE	PE	PE	PE	PE		PE		PE	
GYN Nurse Practitioner													
Health Promotion Nurse						**AVAILABLE**							
Independent Duty Corpsman	SDA	SDA	ROU		SDA	ROU	SDA		ROU	SDA	ROU		SDA

Note. SDA indicates same day appointment. ROU indicates routine appointment. URG indicates urgent appointment. PE indicates physical examination. CONS indicates Consultation. F/U indicates follow-up. CERT indicates Certification.

Appendix P

Providers	11:00 AM	11:20 AM	11:30 AM	11:40 AM	12:00 PM	1:00 PM	1:20 PM	1:30 PM	1:40 PM	2:00 PM	2:20 PM	2:30 PM	2:40 PM
						EXAM TIMES							
Family Physician (DEPT HD)	ROU	ROU			LUNCH	SDA	SDA						
Family Physician					LUNCH	SDA	ROU		ROU	SDA	ROU		ROU
Internist A	ROU				LUNCH		ROU		ROU	ROU	ROU	ROU	ROU
Internist B						ROU	ROU		ROU	ROU		ROU	ROU
Pediatrician	URG				LUNCH	URG	URG		URG	F/U	F/U		F/U
General Medical Officer A		FLOAT PROVIDER			LUNCH				FLOAT PROVIDER				
General Medical Officer B					LUNCH	SDA	ROU		ROU	ROU	ROU		ROU
USUHS Physician A	ROU												
USUHS Physician B	ROU	ROU			LUNCH	SDA			ROU	ROU	ROU		
Occupational Medicine Physician					LUNCH	CONS			CERT	F/U	CERT		CERT
Physician Assistant						SDA	ROU		ROU	SDA	ROU	SDA	SDA
Nurse Practitioner A					LUNCH	SDA	ROU		ROU	ROU	ROU		ROU
Nurse Practitioner B						SDA	ROU		ROU	ROU	ROU		ROU
GYN Nurse Practitioner						PAP			PAP	PAP	PAP	PAP	
Health Promotion Nurse	LUNCH					AVAILABLE							
Independent Duty Corpsman	ROU	SDA			LUNCH				ROU	ROU	ROU		ROU

Note. SDA indicates same day appointment. ROU indicates routine appointment. URG indicates urgent appointment. CONS indicates Consultation. F/U indicates follow-up. CERT indicates Certification. PAP indicates Pap Smear.
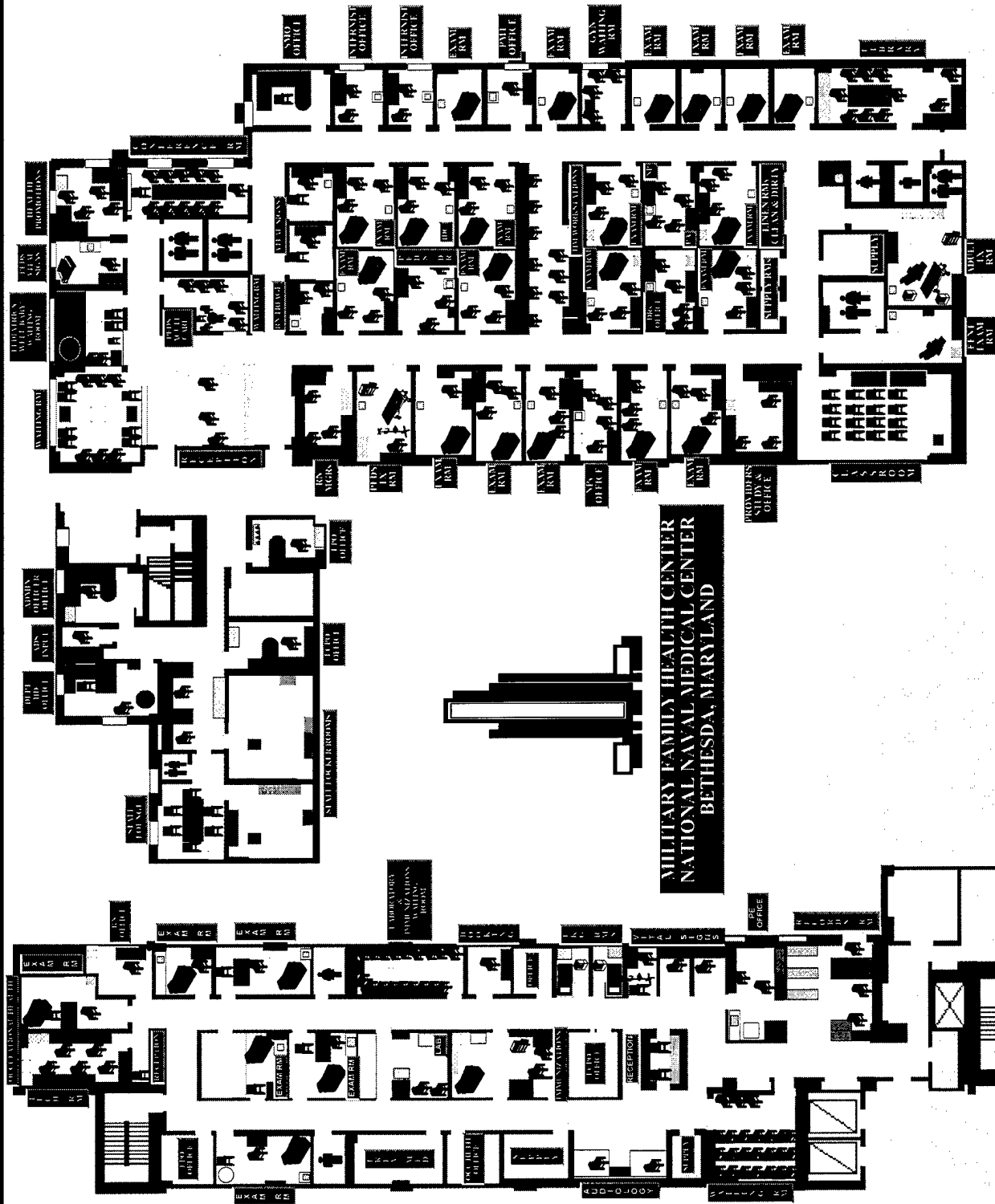
Appendix P
Military Family Health Center Sample Provider's Schedule

Providers	EXAM TIMES												
	3:00 PM	3:20 PM	3:30 PM	3:40 PM	4:00 PM	4:20 PM	4:30 PM	4:40 PM	5:00 PM	6:00 PM	6:20 PM	6:30 PM	6:40 PM
Family Physician (DEPT HD)													
Family Physician	ROU												
Internist A		ROU	ROU										
Internist B		ROU	ROU		ROU			ROU	DINNER			ROU	
Pediatrician	F/U	F/U											
General Medical Officer A			FLOAT PROVIDER										
General Medical Officer B													
USUHS Physician A													
USUHS Physician B													
Occupational Medicine Physician													
Physician Assistant	ROU	SDA		ROU	SDA	ROU							
Nurse Practitioner A								SDA	DINNER		ROU		SDA
Nurse Practitioner B													
GYN Nurse Practitioner	PAP	PAP		PAP									
Health Promotion Nurse													
Independent Duty Corpsman													

Note. SDA indicates same day appointment. ROU indicates routine appointment. F/U indicates follow-up. PAP indicates Pap smear.

Appendix P
Military Family Health Center Sample Provider's Schedule

Providers	EXAM TIMES					
	7:00 PM	7:20 PM	7:30 PM	7:40 PM	8:00 PM	
Family Physician (DEPT HD)						
Family Physician						
Internist A						
Internist B	SDA		ROU			
Pediatrician						
General Medical Officer A						
General Medical Officer B						
USUHS Physician A						
USUHS Physician B						
Occupational Medicine Physician						
Physician Assistant	ROU	SDA		ROU		
Nurse Practitioner A						
Nurse Practitioner B						
GYN Nurse Practitioner						
Health Promotion Nurse						
Independent Duty Corpsman						

Note. SDA indicates same day appointment. ROU indicates routine appointment.

MILITARY FAMILY HEALTH CENTER
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BETHESDA, MARYLAND

FIRST FLOOR

SECOND FLOOR

MILITARY FAMILY HEALTH CENTER
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FIRST FLOOR

SECOND FLOOR